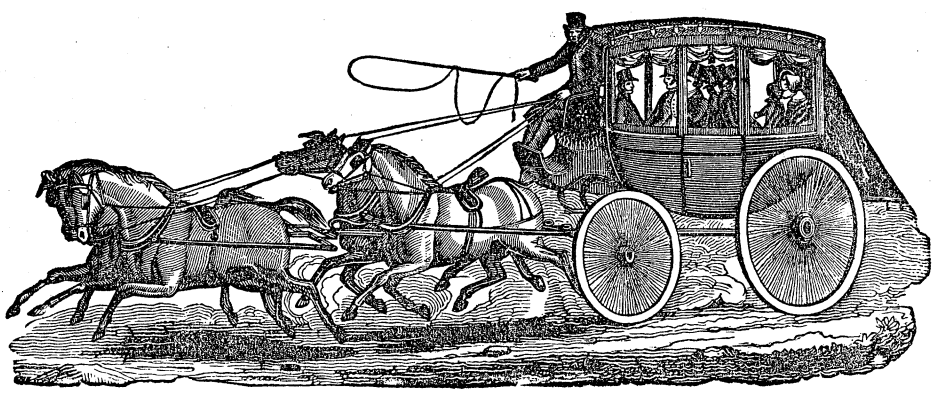
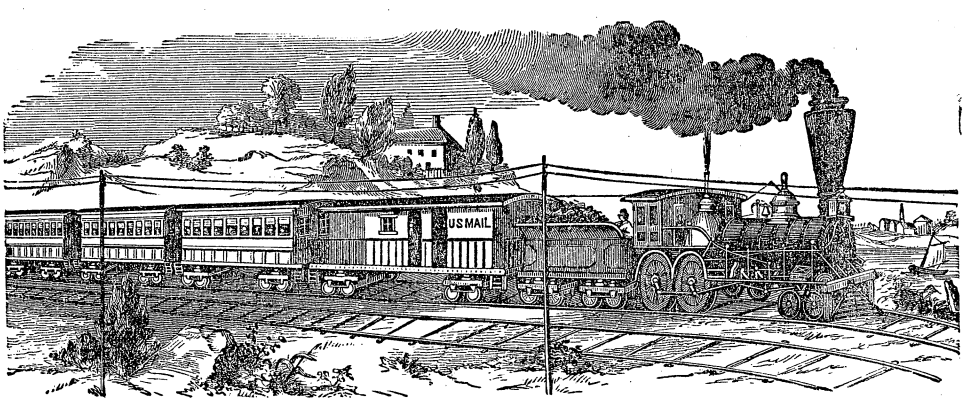
TRAVEL AND TRANSPORTATION,

STEAM ENGINES,

MANUFACTURES, MACHINERY, &c.





IMPROVEMENTS IN TRAVEL AND TRANSPORTATION ILLUSTRATED.

TRAVEL AND TRANSPORTATION.

CHAPTER I.

EARLY ROADS—POST ROADS—MACADAM—NATIONAL.

Of all the marvels that have marked the present century, those which manifest themselves in the development of the means of locomotion and transportation are among the most wonderful. With the emancipation of the states from their colonial condition, and the formation of a federal government, a most extraordinary activity seems to have been imparted to the inventive faculties of the American people, and to which side soever we direct our attention, we find that all the great and useful creations of genius take date from that auspicious event. The art of transportation has, as it were, been created. Not that our fathers were not possessed of the means of transportation by land or water, but those means were so immeasurably below those now in use, that it may be fairly claimed that a new art has been created. When our fathers landed on these shores, it is easily understood that they found no roads, or carriages, or other means of moving from one place to another. Indeed, the countries they had left were at that time but poorly provided with such means, as compared with what they have at present.

The first attempts to exchange the products of labor, which mark the nascent commerce of a people emerging from barbarism, are developed through manual labor, and the application of the strength of animals in a rude and imperfect way. The peddler with his pack, and progressively his pack-horse, are the instruments of intercourse in an infant society. From village to village, pathways are formed, wheel-carriages are invented to gather the fruits of harvests, and they wear their own paths upon the surface of the soil, and finally the road is constructed, more or less perfect, as a means of transport between places more or less distant. In such a state of affairs the roads are very imperfect, and the carriages of the rudest description. It is conceivable that the first step from the pack-horse and its pathway, to the two-wheeled cart and a road was a very great advance—nearly as much as from the road to the railway. And this improvement has by no means been of so distant a date as at first we might imagine. Not only is the construction of good roads of very recent date, but up to the present moment a very large portion of the world called civilized is without them. Certain parts of Europe, the French colony of Algiers, and the United States alone possess them. In other words, but little more than one-quarter of the inhabited part of the globe is provided with roads. In China a large part of the internal land transportation is upon human backs. With the exception of one or two important communities, the extensive empire of Russia, with 60,000,000 inhabitants, is without roads; communication is kept up only in the winter, when the ground is frozen, by sledges. Spain is little better off than Russia, and Italy has few of such improvements.

The condition of affairs in this country before the construction of roads is evident to the hardy pioneers of the western frontier, and has been at times common to every part of the country. The first settlers on arriving here, it is certain, found no roads, and were not skilled in following an Indian trail. They built their houses upon the summits of hills, as well to avoid the miasmata of swamps as to get notice of the approach of hostile savages. The connection between these houses was by foot-paths that became horse tracks, and with the progress of events were enlarged into wagon roads. These, ultimately fenced in, became the highways, running irregularly over the face of the country, as they were prolonged by settlements. The science of road making never guided their direction, nor would farmers

permit the squareness of their fields to give place to the straightness of roads. These highways are made in the general idea of making the passage of a vehicle between any two given points possible, and various expedients are resorted to, to overcome obstacles at the smallest expense. The plough turns up the sides, and the scraper draws the earth to the summit, which is levelled off to be hardened by travel. The reduction of hills or the filling in of swamps is not resorted to in new settlements, but the latter are mostly made passable by laying down logs across the track, and parallel with each other. This (*corduroy*) road is better than a swamp, but offers so great resistance that a far less load can be drawn over it than over a smooth, level road. The roads of the whole country, encountering these natural difficulties, took their character from their location, and transportation in each district was more or less difficult, according to circumstances. The best roads of the day were such as would now nowhere be tolerated; as a general thing, the water-courses, so abundant in the country, were the main arteries, and most roads were directed toward these, or in the neighborhood of a large city they converged upon it as a common centre.

The number of even these roads at the date of the formation of the government was not large, nor was their quality to be admired. The streams and water-courses were well supplied with small craft, that delivered goods and produce between distant points, but where the route left the water, the transportation became difficult and expensive. The war and its success had deeply stirred the public mind, and imparted full activity to the independent genius and enterprise of the people. Those 3,000,000 of souls occupied, as it were, but a foothold on this immense continent, to the ultimate possession of the whole of which they already looked forward. The means of transportation were the first object and desire that presented themselves to thinking men. Steam, as a power of locomotion, was unknown, and the science of road making little developed. Canals, therefore, presented themselves almost simultaneously to leading men in various sections. General Washington had, before he attained his twenty-first year, crossed the mountains and given his careful attention as an engineer to the subject of canals, more particularly the connection of the Chesapeake with the Ohio river. At a subsequent period he received the thanks of the Virginia House for his report on the results of his examination of the valley of the Ohio. And the war had no sooner closed than we find him, in 1784, presiding at a commission sitting at Annapolis, on behalf of Maryland and Virginia, to consider the improvement of the navigation of the Potomac, which improvement ultimately, in after years, became a canal to Pittsburg. General Washington, as an engineer, always took an active interest in works of internal improvement. When the Dismal Swamp canal, connecting the Chesapeake, at Norfolk, Va., with Edenton, Albemarle Sound, North Carolina, a distance of 28 miles, through the vast Dismal Swamp, was projected and executed at the expense of individuals with some government aid, he took some of the stock. One certificate of this stock, originally issued to him for £300, or $1,000, was sold in 1825, at auction, in Alexandria, for $12,100, to Judge Washington. Pennsylvania, nearly at the same time, appointed commissioners to explore routes for connecting the Delaware with the lakes. They reported in favor of the Juniata, partly by canal and partly by river. The result was a charter of the Schuylkill and Susquehanna Company, in 1789, and the Delaware and Schuylkill in the following year, with $400,000 capital. In New York the active mind of Gouverneur Morris had already projected the Erie canal. In Massachusetts, the Middlesex canal, 30 miles, was authorized in 1789, and navigated in 1804. In South Carolina the Santee canal was finished in 1802. These, with many other events, show the activity of the public mind at the date of the birth of the Union, in relation to means of transportation. It will be remembered, however, that the people were then few in number. They were heavily in debt. Their productions were small and trade limited. There was no surplus capital to carry out those magnificent ideas, which were in advance of the times. The natural water-courses of the country ran through the finest farms and delivered most of the produce upon noble bays, which were well provided with ships to transport it abroad for sale. This natural traffic absorbed all the commercial capital of the country, but it was so profitable that in the course of a few years it supplied accumulations for other objects, and it was left for a few years later to witness the prosecution of great en-

terprises. The roads of the country were in a terrible state, however, and since the new constitution had empowered Congress to establish post-offices and post-roads for the conveyance of the mails, it became its duty to look to the roads, and this was the first practical bond of union between the states. A systematic connection of every town in the whole thirteen states, by state routes under one organization, completed the means of communication and established passenger routes. The statistics of the post-office afford a very good indication of the progress of that kind of transportation :—

MAIL SERVICE.

	No. of post offices.	Miles post roads.	By stages. Miles.	Sulkies and horses. Miles.	Steam. Miles.	Rail. Miles.	Annual. Miles.
1791.....	89	1,905	89,650	756,818	..	..	846,468
1811.....	2,403	37,031	2,534,102	3,058,960	..	..	5,592,652
1833.....	8,450	115,176	17,693,839	8,531,909	628,737	..	26,854,485
1859.....	27,977	260,052	23,448,398	27,021,658	4,569,962	27,268,384	86,308,402

This table gives the transportation of the mail in the first year of its operation; in 1811, when steamboats began to run; in 1833, when railroads began to claim a share; and in the past year, when all these means have been more fully developed in all sections of the country. There are thus three distinct periods of transportation: 1790 to 1810 were 20 years of common roads and sail vessels; from 1810 to 1830 were 20 years of canals and steamboat progress; and since 1830 there have been 30 years of railroad progress, which has produced immense results, throwing an entire net-work over the surface of the country between the Atlantic and the Mississippi, and superseding other means of transportation. It is to be observed that in the first year of the operations of the post-office department, there were but 1,905 miles of post-roads, and that on these, nine-tenths of the service was on horseback, the stage service being very small; but as the roads were improved up to 1811, the stage service came nearly to equal the horse service. From that date steam began to take the mails that ran on or near water-courses, and subsequently to 1830 the railroads began to compete with the stages on land; since that time the stage service has increased but six millions, while in the previous 20 years it had increased over fifteen millions of miles. The extension of post routes has been in 70 years, it appears, over 258,000 miles in the whole country, and the federal government has taken an active part in the extension of roads. The most important work of this kind undertaken was the Cumberland or national route across Ohio, Indiana, and Illinois to St. Louis. For this purpose, large annual appropriations were made by Congress. Other roads in many directions were projected, particularly from Washington to New Orleans; and in the frontier states, numerous roads were constructed by the troops under the direction of the war department.

It was thus that the federal government imitated imperial Rome, which in the days of its power clearly understood that that power was to be maintained only by the rapid march of its legions. From the "eternal city," noble causeways ran to the remotest corners of the then world. These were military routes simply, and intelligence was conveyed upon them from station to station with great rapidity. On the fall of the empire, those noble works, instead of being preserved for the uses of commerce, were in a great measure demolished by small states, as a means of preventing invasion. Nevertheless, those Roman roads remained the best roads in England down to the present century. What is called Ermine street connected London with Carlisle, in Cumberland. Another is known as Watling street. Apart from those old works, the roads of England were no better than those of this country up to the present century. In this respect there is great difference between the works of the Romans and those of the United States. Those old Roman roads had no competitors. During 1,400 years they continued the best means of conveyance. The United States roads, on the other hand, were hardly done before the inventive spirit of the age set up a successful rival in the giant railway, which has become *the* trunk road. The French government, under the empire, saw the necessity of roads, and began a system for Europe. The noble way over the Simplon was the first of these. With the fall of the empire that system became confined to France, but has since been vigorously pushed—$20,000,000 per annum was expended for many years in their construction.

There were in 1815, 3,000 leagues of "royal" roads, and these had increased to 10,000 in 1850. 2,000 leagues of departmental, or county roads had, in the same time, increased to 12,100, and town roads were extended by 15,000 leagues. These extended means of communication have imparted to French prosperity much of its strength.

In the United States the impulse given to road building by the federal government was taken up by the several states, if not directly at the public expense, yet by laws which compel inhabitants to work on the local roads. These regulations are different in different states. The essential features of all the laws are nearly the same as in the state of New York, where the directing power is in "commissioners of highways," who are chosen in each town. Under these overseers are also chosen. The commissioners direct as to the grade of the road, general shape, drainage, etc. The overseers summon the persons who are to work, see that they do actually work, collect fines and commutation money. Every person owning land, and every male over twenty-one years, is assessed to work. The whole number of days' work shall be at least three times the number of inhabitants in each town. Under this system the roads are never very good. The commissioners work gratuitously, and skill, labor, and time are never to be had for that price. The overseers, being changed every year, are never experienced in the undertaking. The men they summon go to it as a half holiday, and the work the overseer sets them at is pretty sure to be that which most benefits his own place. The money subscribed is not expended in the best manner. These are all circumstances which do not favor the construction of such roads as will greatly reduce the cost of transportation. In the laying out of the road in this way, a passable track is the most aimed at.

To admit vehicles, the track must be cleared of wood by the ax-men, swamps must be overlaid with materials, rivers bridged, and the route laid around hills in order to avoid the difficulties of ascent. These are the main points to make a road practicable. It is very soon discovered that transportation on a bad road is much more expensive than on a good, and efforts are accordingly made by the most enterprising to improve the bad roads. The first step is to make the roads in such a manner as to accommodate the greatest nnmber of people, and at the same time allow the largest loads to be drawn by horses. The better the road the larger will be the load that a team, or two horses, can draw at a given speed, and of course, the cheaper the transportation. It is to be understood, however, that the road must be equally good for the whole distance that a load is to be drawn, since if there is a space where great difficulties are to be encountered, the load must be gauged to meet that difficulty, no matter how good may be the remainder of the road. If a highroad leading through one township is not kept up, it neutralizes the public spirit of those adjoining; hence the necessity of a general system to insure continuous cheap transportation. To effect this, science has devoted its attention, but with little effect in the manner that country roads are made and kept in repair. The requisites of a road are: 1st, straightness, because straight lines are the shortest; 2d, it should be as level as possible, because every ascent causes a loss of power. Thus, if a horse draws on an ordinary level road two tons, and comes to an ascent of one foot in every twenty, he cannot ascend, because, in addition to the draught, he must lift up 200 pounds, or one-twentieth of the whole weight through the whole height. To make the road level, and save this labor and expense, the road must wind round the hill. There is little lost by this, because generally it is no further round than over. To prove this, cut an egg in half longitudinally, and set it upon the table; the line which goes round the base is the same as that which goes over the top. The half of an apple or any similar body will give the same result. Even if it were longer, it is better to go round, since the horse can do the last and not the other. The road should never be less than a rod wide, to allow two vehicles to pass. The surface of the road must be as smooth and hard as possible, in order to overcome as much as possible the resistance offered by sinking in, which is very serious, because the depression creates little hills before the wheels. Thus, if a wheel four feet in diameter sinks in one inch, to overcome the resistance thus offered one-seventh of the load would require to be lifted up over it. The harder the road, the less the resistance from this source. The greater the number of stones, hard substances, and inequalities there are to be encountered, the greater the resistance from collision. The resistance of *friction* is propor-

tional to the roughness of the road, and the extremes of this may be illustrated by a carriage wheel on gravel and a rail wheel. The loss of power on a road, or in other words, the cost of transportation, is increased in proportion to the increase of these resistances, and inversely as they are diminished. To overcome them many improvements have been gradually adopted, such as earth, gravel, broken stone, stone pavements, wood, and railroads.

In marshy forests charcoal roads are made. Timber from 6 to 18 inches thick is cut, 24 feet long, and piled up lengthwise in the centre of the road in such a manner that the pile will be about 12 feet high. This is covered with earth, taken from ditches on either side. When the wood is charred, the coal is raked down to the width of 10 feet, with a depth of two feet in the centre and one at the side. Such a road becomes very compact, and free from dust. Such a one in Michigan cost $660 per mile.

In the older states mostly plank roads were at one time favorites, and many hundreds of miles were constructed at a cost of $1,250 per mile. This plan has been generally abandoned. The roads not kept up are a nuisance, and many have been complained of, and removed as such.

Gravel roads have sometimes been made with the gravel from the shores of rivers, but the resistance offered by these roads is considerable.

The modes of road making here alluded to, are those which are prevalent mostly in the country districts, and where the work is performed as a tax. These answer for cross roads; but the great thoroughfares were taken in hand either by the state or by authorized companies.

Turnpike companies were chartered by most of the states, with the intention that they should construct roads having all the requisites of the best routes, and they were authorized to make a charge to those who use them. These, like most corporations, were subject to abuse; and the people were compelled to pay tolls when they had gained nothing in the way of easier transportation. New England, New York, Pennsylvania, and other states, authorized a number of companies which answered a purpose before railroads. The New York turnpike laws enact that vehicles having tires six inches wide shall pay half tolls, those with nine inches, one quarter, and those 12 inches, none at all. These enactments were designed to encourage the use of broad tires, as being less destructive to roads, but where the road is well made, as on the Macadam plan, the breadth of the tire has no effect; on the other hand, the horses' feet do the most damage. It has been calculated that a set of tires will, in average weather, on a macadamized road, run 2,700 miles, but that a set of shoes will bear only 200 miles travel.

The Macadam road, invented by a Scotch gentleman of that name, was introduced in 1820. The principle is simply that stones broken into angular fragments not over a certain size, say that of a pigeon's egg, will, under the pressure of wheels, combine into a compact mass, excluding all water, and, therefore, not subject to the action of frost, and be as solid as the original stone. These have proved to be the best roads, answering most of the conditions, and, therefore, allowing of transportation at the smallest cost. Good, well-made pavements, as used in cities, are better, since they give little resistance, and afford a foothold to the horses. In order to understand the difference in value of these roads, it may be remarked that a machine has been invented called a dynamometer. It resembles a spring balance; one end is connected with the carriage, and the other with the horses, and the power they exert is shown by the index. By such an instrument it was determined that, on a gravel and earth road, the resistance to draught of one ton was 147 lbs.; on a Macadam road, 65 lbs.; on a good pavement, 33 lbs.; and on a rail track, 8 lbs. Whence it appears that a horse can draw three times as much on a Macadam road as on an earth road; on a pavement, four and a half times as much; on a railway, eighteen times as much.

These figures indicate the gradual advance made in the power of transportation, since the roads, under the action of the state and federal government, and of the enterprising towns and cities, gradually improved from mere wagon ways to well-constructed roads in those sections where land carriage was most used. While individuals, companies, and states thus contributed to the improvement of roads, the federal government entered the field with greater vigor.

There were two motives for the construction of roads and internal improvements by the federal government. The first was to facilitate the mails; and the second was to

facilitate communication. It was obvious that the new and infant states had little means to expend in the construction of roads that were to be more or less for the general benefit. The government, therefore, in organizing new states upon the national territory, made provision for the construction of roads out of the proceeds of the public lands sold within each state. The government everywhere constructed numerous roads, and after the war of 1812, when its finances began to be easy, it employed the French General Bernard and a corps of engineers in the construction of fortifications and roads. Among these engineers was Capt. Poussin. This gentleman went back to France, carrying with him the republican ideas here collected. He there propagated them with such effect that he was, in 1848, when the Revolution chased the last Bourbon from the throne, attached to the Paris *National*, the republican newspaper, and became, in consequence, ambassador of the provisional government to the United States in 1849. Thus, after the lapse of a quarter of a century, returning to the scene of his early labors.

When the state of Ohio was admitted into the Union, there were very few roads there, and the federal government was the chief proprietor of the land. It was agreed, therefore, that two per cent. of the proceeds of the land sold should be applied to the making of a road leading to the state. The same condition was made when Indiana, Illinois, Missouri, Mississippi, and Alabama were admitted, and the road was commenced. A turnpike road from Baltimore, 170 miles to Wheeling, was laid out, and a similar road from Washington, 150 miles to Cumberland was constructed. From that point the Cumberland road runs 135 miles to the east bank of the Ohio; of this distance, 85 miles are in Pennsylvania, 35 in Maryland, and 15 in Virginia. This was extended west 80 miles to Zanesville, and so through the states of Ohio, Indiana, and Illinois, to St. Louis. The road has cost the government over $3,500,000. Its effect upon transportation was very great. Before its construction it required, to go from Baltimore to Wheeling, 8 days. This was reduced to 3 days. The figures were the same for the length of travel from Washington to Wheeling. Its influence upon the country through which it ran was great. Villages multiplied in its neighborhood, and the value of property was much enhanced. The city of Wheeling was particularly influenced by it. In the year 1828 it forwarded to Baltimore over that road 3,500,000 lbs. or 1,750 tons of produce, by over 1,000 wagons. Anticipations were then indulged that a small reduction in the cost of transport would bring 100,000 tons of Ohio produce over the road to Baltimore. They did not then foresee that the reduction in cost would be brought about only by rails to Baltimore.

The Cumberland road by no means monopolized the attention of Congress, but roads were constructed in most of the states under the war department, and in the new states the army was employed in making them. Some 800 miles were thus made in Arkansas. We may allude to a few of these roads, as that to Mars Hill, Maine; Detroit to Fort Gratiot, Michigan; do. to Saginaw bay; do. to Chicago; Laplaisance bay to the Chicago road; Fort Howard and Fort Crawford; road to Chattahoochee; canal surveys in Florida; road to Apalachicola; Pensacola bay to Pittsburg, Miss.; road from Jackson to Fulton, Mississippi; Memphis to Little Rock; Green bay to Winnebago. These few names of roads spreading from Maine to Arkansas and Florida will give an idea of the extended works of the government, which also embraced removing obstructions of rivers and improving river navigation. A grand system of internal improvements was thus developed, until its growing magnitude made it a political issue, and the whole system came to an end under the Maysville road veto of General Jackson. The principle was adopted by one party, that the federal government had no power to construct any but strictly national works, or not any that were entirely within a single state. The system thus came to a violent end, after an expenditure of some $30,000,000, but not until railroads had begun already to supersede canals and roads. The federal government had thus lent a powerful hand to the extension of highways. The great thoroughfares that it had laid open had facilitated migration and settlement, and wherever these had taken place, local roads multiplied, until we find that in the present year there are 260,052 miles of post-road in the Union.

The mails of the government were given out by contract to the highest bidder for four years' service. The whole mail service was divided into sections, north, east, west, and south, each being let for four years, but

every year one of those fell due. The contractors agreed to deliver the mails on certain routes in a given time, for a certain amount of money. The mail money was generally depended upon for the expenses of running the vehicles, and such passengers as could be carried by the same conveyance afforded a profit. Thus the system for the circulation of letters and newspapers became the machinery for the circulation of the people. These accommodations were, however, far from being luxurious at a distance from the great cities. In these, indeed, the staging was conducted in a style approaching the splendid. The eastern stages running into Boston, and penetrating into every part of New England, were celebrated for their quality and style, as were those of New York, Philadelphia, and Baltimore, and most other large cities that were the centres of traffic, as well as post service. The different "lines" ran such opposition, as reduced the fare and promoted speed. The dandy "turn-out" being ready at the hour, well dressed, polite, smart drivers received the "ribbons" with gloved hands, and the "team" went through with a skill that could get the best time out of the nature of the road. As the traveller receded from the great centres, he found the "teams" worse, and the roads to match. The mails ran fewer times in the week, the vehicle dwindled from the easy coach to the covered spring wagon, to the open wagon without springs, ultimately to the horse, and finally perhaps to a man's back, and the traveller's accommodation diminished in proportion.

CHAPTER II.

COASTERS—STEAMBOATS—CANALS.

In the neighborhood of the water-courses the traveller was better accommodated by the coasting vessels. The early settlements of the country had been, as a matter of course, upon the coast and on the numerous streams with which the country is supplied. The roads had extended back, more or less, into the country from these settlements, where the freights accumulated at the landings, whence they were carried by water for interchange with other towns, or, as the country grew, to be exported abroad. The wagon charge for freight was always so high as to absorb the value of the produce at moderate distances, and travelling was mostly upon horses, unless water conveyances could be availed of. This was the common mode for long journeys on all the rivers. The following advertisement, from a New York paper early in the present century, gives an idea of the style of travelling in the youth of men now not old.

"Sloop Experiment—for passengers only.—Elias Bunker informs his friends and the public, that he has commenced running a sloop of about 110 tons burthen, between the cities of Hudson and New York, for the purpose of *carrying passengers only*. The owners of this vessel, being desirous to render the passage as short, convenient, and agreeable as possible, have not only taken care to furnish her with the best Beds, Bedding, Liquors, Provisions, &c., but they have been at very great expense and trouble in procuring materials, and building her on the best construction for sailing, and for the accommodation of *ladies and gentlemen travelling on business* or *for pleasure*.

"Merchants and others residing in the northern, eastern, or western counties, will find a *great convenience* in being able to calculate (at home) the precise time they can sail from Hudson and New York, *without being under the necessity of taking their beds and bedding*, and those in New York may so calculate their business as to be certain of comfortable accommodations up the river."

This was evidently no common luxury that Capt. Bunker proffered to an admiring public. They were no longer required to "take up their beds and walk." Ladies and gentlemen travelling for pleasure could now be supplied with bedding, as well as other luxuries, on board a hundred ton sloop, and depend upon the time of her *leaving*. The wary Elias did not commit himself to the time of her arrival, however. Long experience had made him cautious on that point. However, to be certain of leaving was something, since the taking of a passage had been only a preliminary step to a voyage. The completing of the freight, the waiting for a wind, and the notification by means of a black man to be on board at an appointed hour, were now to be dispensed with. This was a great blessing, a good way in advance of the navigation 150 years previous, when permission was granted to a sloop to go from New Amsterdam (New York) to Fort Orange (Albany), provided she did not carry

more than six passengers. This was the mode of reaching most of the large cities. From any point of the eastern coast the best mode of reaching Boston was by the lumber or other coasters. In these the passengers, male and female, were stowed away in a few berths in the cabin, or *sprawled* around upon the uncarpeted floor. Sometimes these vessels, when the freight earnings were eked out by a fair number of passengers, as from Bangor, Portland, or other cities, were raised to the dignity of a "packet," when a few extra berths were decorated with a red bombazette frill of rather a scanty style. In the rainy seasons, spring and fall, these were almost the only modes of travelling. It may be supposed that passengers were not very abundant. The vessels, however, improved in size and accommodation, and the number of passengers still, even in these railroad days, conveyed by them is, perhaps, as large as ever. The speed of these vessels was not great, and the uncertainty of arrival such as now would by no means suit ideas of business. In those seasons of the year when the roads were generally good, the stages would make four miles per hour and arrive in fair time. Such arrangements did not permit frequent visits for the purchase of goods, and most business was done fall and spring, when the goods followed the water-courses as far as possible, and then paid from 15 to 30 cents per ton per mile, according to the difficulties of the route. Even the mail charge was from $6\frac{1}{4}$ to 25 cents per single letter, or a letter on one piece of paper, being $18\frac{3}{4}$ cents for any distance between 150 and 400 miles—envelopes, of course, were not used. Those charges were continued down to 1845, when the reduction took place.

The tonnage employed in the coasting trade had increased from 68,607 in 1789, to 420,362 in 1812. Inasmuch as but little change had taken place in the speed and build of the vessels, the increase indicates the progress of business. In 1807 the enterprising sloop owners who, like Captain Bunker, had conceived the idea of furnished berths for the accommodation of the public, were struck aghast at the success of Fulton's "Clermont"—named after the country seat of Chancellor Livingston—steaming up the river at the rate of four miles an hour under all circumstances. The conservative interests were loud in demonstrating the utter ruin that was to overtake river craft, the occupation of boatmen, and, consequently, the navy, "the country's right arm of defence," by means of this great innovator. Nevertheless, the spark of genius had kindled the flame of invention, and the public were becoming absorbed in it. Each new steamer exceeded the previous ones in build and style, and the machinery underwent as rapid improvement. As usual, however, the public were slow to be convinced. It was admitted, when it could no longer be denied, that steam would answer for the river, but it was held to be idle to attempt the Sound navigation in those new-fangled concerns. This problem was decided in the Fulton by Capt. Bunker, possibly our enterprising friend of the sloop. The "Hell-gate" passage was, in those days, an object of terror. An English frigate had been lost there in the old war, and there were not a few who still held the idea that "the devil only could beat those English who had beat the Dutch." The East River rushing up the Sound at particular times of tide pours a tremendous flood between Ward's and Long Islands. The passage narrows to a few yards, and the tide rushes past the "hog's back" and the "gridiron," turns at right angles, and forms a foaming whirlpool around the "pot-rock," which, even with the surface of the water, is fatal to any vessel that touches it. Through that "gate of Hell" the steamer was to pass, and the operation was described by a passenger as follows:—

"I remember the long-agitated question, whether steamboats could be made capable of sea navigation, or so constructed as to traverse our sounds, bays, and coasts in safety. This question was put to rest by the enterprise and skill of Capt. Bunker. In the Fulton, constructed, I am told, with a view to crossing the Atlantic, he undertook the navigation of Long Island Sound, an arm of the sea in which the most severe tempests are often encountered. During a season of no extraordinary moderation, including the two equinoctial gales, Capt. B. lost but a single trip. Another doubt remained to be removed. It was supposed impossible to pass the celebrated passage of Hell-gate against the tide, at the strength of the current. This was reserved for Capt. Bunker to remove, and I happened to be on board at the time of the novel and interesting experiment, returning southward from New Hampshire. A number of respectable passengers witnessed the performance. It was in the boat Connecticut, built with all the strength to be obtained

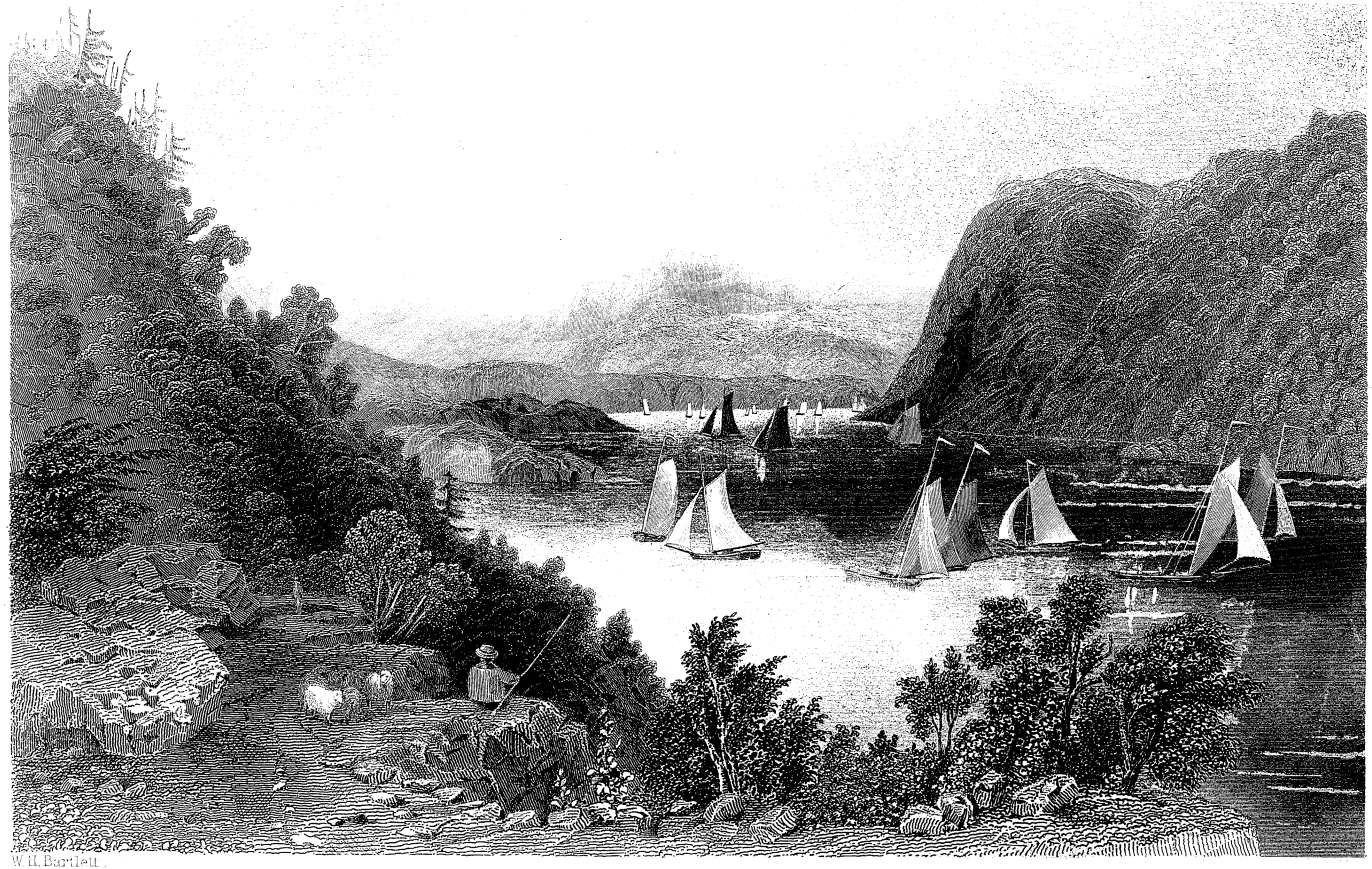
and careful workmanship. The machinist (McQueen) was accompanying his engine to prove its powers, with careful and ingenious assistants, and some of the owners were on board also. The first attempt to pass the point of greatest pressure of the contracted stream was unsuccessful, and the boat was compelled to retreat into an eddy and increase her steam. With renovated power the effort was repeated, every man fixed immovable at his post, the passengers properly stationed in different parts of the boat, the engineers employing their utmost diligence to force the passage. They were again defeated by the supposed resistless stream, and again retreated, racked, strained, and shivering, from the contest. After a short pause and fresh preparation, it was resolved by the parties concerned to make a third endeavor, and test the strength of the machinery by the greatest trial it could ever be expected to bear. After a severe struggle, in which a weaker vessel would have been disjointed and torn to pieces, the headstrong current yielded to the giant power of steam, and the triumph of art over nature was effected. A few moments of greater breathless anxiety I scarcely ever witnessed. Mechanical science achieved a victory over elementary force, and overcame an obstacle heretofore deemed in this manner altogether insurmountable. The courage and perseverance of Capt. B. were so conspicuous on this occasion, that I can never forget the impression made on all present. We have since found it as easy to traverse our sea-board, navigate the Mississippi, and cross the Atlantic, as it was to find America after Columbus had broken the egg."

To those who now so frequently make that dire passage without knowing it, this animated description must afford surprise as well as amusement. It is suggestive, not so much of the temerity of the "bold navigators" of that day, as of the feeble nature of the boats then built. The passage, to be sure, has now been deprived of some of its "horrors" by the removal of the pot-rock, which has been broken by gunpowder blasts to a depth which leaves it no longer dangerous. The noble steamers of the present day pass through at all times of tide, without apparently feeling the current, instead of butting at it three times "strained and shivering." The steamboat, after performing this feat, passed up the Connecticut river for the first time to Middletown. The North River boats continued to improve, and the time of the Clermont—36 hours to Albany—was, in 1820, reduced by the Paragon to 20 hours. In 1823, however, the time from New York to Providence, 200 miles, was 20 hours, and the stage to Boston completed the route, 40 miles, in 6 hours more, making 26 hours. At that date steamers were multiplying on all the Atlantic rivers and bays, and on the western rivers, as well as on the lakes. In 1819 the first steamer crossed the Atlantic from Savannah, Georgia, to England. In 1825 the Chief Justice Marshall had reduced the time to Albany to 14 hours 30 minutes. The progress in speed may be seen at a glance in the following figures:—

1811,	Clermont's time to Albany,	4 ms. per h.,	36 hs.
1820,	Paragon,	" "	27
1825,	Chief Justice Marshall,	"	14.30
1840,	Knickerbocker,	"	9.33
1860,	average time 18 miles per hour,		8

With the opening of the Erie canal in 1825, the quantity of goods going and coming much increased the demand for transportation, and barges in tow of steamers began a new era in that buisness. That goods could be carried west on the canal, and so by continuous water-courses on the lakes and their affluents, induced more passengers by the same route. In 1841 the improved method of propelling by screw was introduced by the patent of Capt. Ericsson. The iron screw steamer R. F. Stockton, of 72 tons, came from Liverpool under the command of Capt. Crane, and became a tug on the Raritan canal. Those steamers now gradually gained ground in public favor. The speed was long not so great as that of the paddle wheels. This has been gradually overcome by improved models and forms of screw, until in the month of October, 1860, two propellers of 100 feet length were launched for the North River trade, and made time 18 miles per hour, being the fastest boats for their length afloat. This class of vessels may ultimately be exclusively used in the European trade.

The settlers who had crossed the mountains in the early times of the government had located mostly on the great streams, within easy reach of the means of conveying the surplus to points of sale. They were not provided with vessels of a very expensive construction; and flat boats were the chief means of descending the streams. These vessels, designed only to go down stream, were composed of such material as, after

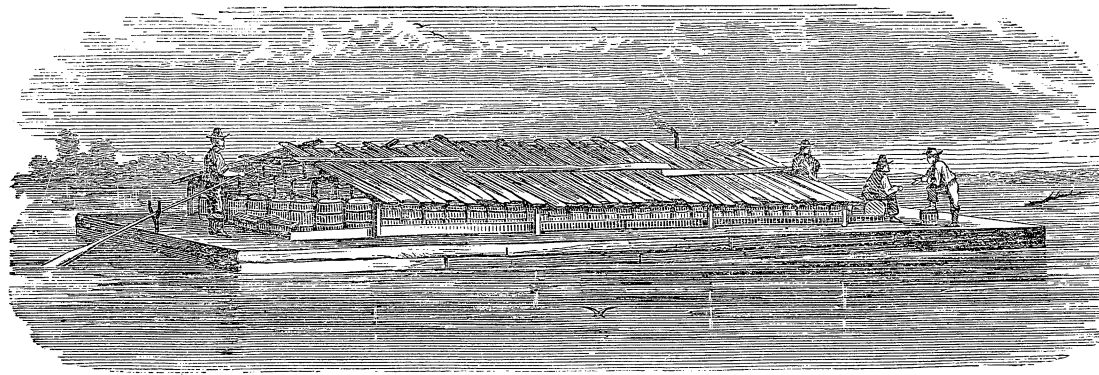


W. H. Bartlett

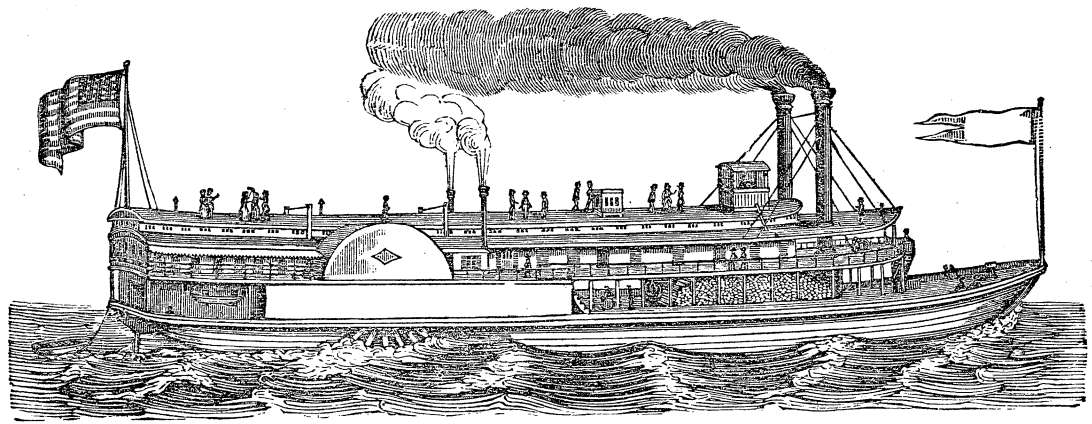
CAPT. BUNKERS SLOOP, NORTH RIVER.

(Hudson Highlands)

having served the purpose of transporting produce, could be broken up at the place of destination, and sold as lumber. These were improved into keel boats, for the purpose of ascending the streams, and in either case were propelled by long poles in the hands of the boatmen. These, standing on the gunwale at the extreme bow of the boat, thrust the pole into the mud, and setting the shoulder against the top, pushed the boat forward with the feet in walking toward the stern, which reached, they drew up the pole, walked back, and repeated the movement. In this laborious mode of travel, all the merchandise sent from the east, *via* New Orleans, reached its destination. It required four months to travel thus from New Orleans to St. Louis—a distance of 1,500 miles, and the cost of the goods, it may well be supposed, was enhanced by the process; while, on the other hand, the produce sent down realized but little. Thus, between the cheapness of the produce and the dearness of merchandise received in exchange, the settler realized but little for his labor. It is easy to conceive how great a blessing was steam on those waters, to enable the weary men to stem the ceaseless, downward flow of the mighty currents. In 1811 that blessing made its appearance at Pittsburg in the shape of a steamboat, built by Fulton, and which had a considerable success. The general progress was, however, slow, for the reason, among others, that, as in all such cases, there was a large capital invested in river craft, which would depreciate in value in face of the new power, and there was not much capital to embark all at once in steam. It was also the case that ChancellorLivingston, the partner of Fulton, claimed a monopoly of the lower Mississippi trade, and put a restraint for some years upon steam in that region. So great a power could not, however, but force its way. With the construction of the Enterprise, in 1815, St. Louis was reached in 25 days from New Orleans, and public enthusiasm was aroused. There were, however, up to 1817, still but twelve boats upon the western waters, of an aggregate tonnage of 2,335 tons. The time to Pittsburg was 54 days, of which 36 days was running time. These passages caused much excitement, and a bold merchant predicted that the rate of freight between New Orleans and St. Louis would fall to $3.50 per 100 lbs., but he was regarded as visionary, or what they would now call in Wall-street language a "bear" in freights. His sanguine nature would probably have been surprised could the veil of time have been so lifted as to permit him to see 35 years ahead—the boats of the present day making money at 40 cts. per 100 lbs., and carrying it in three days, instead of 25. The Monongahela and Ohio Steamboat Company claimed patronage because their new crack boats could go nine miles an hour! But they were in advance of the times; that speed was thought to be dangerous, even if possible. Those people are now, however, not quite satisfied unless the speed is equal to 25 miles in still water. The war had given a new impulse to settlements west; the more so that steam now so much facilitated travel, and freights multiplied in proportion. Thus reciprocally the improved means of travel induced more locomotion, and increased traffic more demand for vessels. The multiplying boats and more rapid passages still found a sufficiency of business, and even the old river craft were kept in requisition for tow boats. Cincinnati began to build barges of 100 tons to go to New Orleans in tow of steamers; and the Etna made the passage down in fifteen days, reflecting great glory on the commercial enterprise of that city, and its citizens became elated. A Cincinnati writer of 1817 estimates the territory drained commercially by that city at 10,000 square miles, and remarks: "Supposing this settled by 40,000 families, and that each farm would give two tons annual surplus for exportation, there would be 80,000 tons to send to New Orleans, or freight for 800 boats of 100 tons each." The writer apologizes for the extravagance of this estimate. Commercial enterprise began to seek new routes. In 1823 three keel boats in tow passed 450 miles up the Wabash river. It was not until 1826 that the first steamer ran up the Alleghany river. In the same year the ship Illinois reached St. Louis from New York, *via* New Orleans, 3,000 miles, in twenty-nine days and a half, and the first steamer ran up the Susquehanna to Tioga. The opening of the Erie canal, in 1825, caused a great change in travel. Thus the journey from New York to Pittsburg was accomplished by canal, with only eight days staging, and thence down the river to New Orleans. In 1824 the passage up from New Orleans to New York, *via* Pittsburg, was made in 24 days, at an expense of $90. The passage from Natchez to Philadelphia, 2,000 miles, was equal to 17 days. In



FLATBOAT FROM ST. LOUIS TO NEW ORLEANS, TIME FOUR MONTHS.



STEAMBOAT FROM NEW ORLEANS TO ST. LOUIS, TIME THREE DAYS.

the same year a remarkable voyage was projected from Charleston to Green Bay. It was a sloop of six tons, with six passengers, and it reached Rochester in 15 days from Charleston. The passage of a gentleman from Detroit to Washington and back in 16 days was regarded as a miracle.

The remarkable progress of steam upon the Mississippi may be estimated most readily by a table of the passages at different periods, as follows:—

NEW ORLEANS TO ST. LOUIS—1,300 MILES.

Prior to steam			120 days.	
1815,	Steamer	Enterprise	25 "	
1823,	"	average passages	12 "	
1826,	"	General Brown	9 "	12 hours.
1828,	"	"	9 "	4 "
1860,	"	running time	3 "	

The time between New Orleans and St. Louis was thus diminished under the various improvements suggested by experience in the form and mode of running steamers. A boat of 350 tons when fitted out will now cost some $50,000, and will carry 500 tons down stream, or 1,500 bales of cotton on deck. Twenty years ago the freight of cotton down from Memphis was $2 per bale, and below Natchez $1 per bale. The charge for freight up from New Orleans to Natchez was 75 cts. per 100 lbs. As the business increased, larger boats were built. Of these the Eclipse was the type. She carried 1,200 tons, but was too large to pay; and boats are now constructed of a less dimension. The Mississippi boats are large flat-bottomed boats, drawing from 15 to 50 inches of water. The speed depends upon the circumstances of the channel. That of the Memphis, recently built for the St. Louis and Memphis trade, is 18 miles in still water per hour. With light draught and great pressure, a speed equal to 24 miles in still water has been attained. The Altoona ran between Alton and St. Louis, 25 miles, in one hour and forty-five minutes, and in one hour down; average down and up, one hour and twenty-five minutes. Eighteen miles is said to be the time of the western boats. Those rivers flow with gentle currents in mostly shallow water; and there have been various changes in the fashion of the boats. The stern-wheel boat, we believe, is peculiar to those rivers. Instead of having two wheels paddling, one on each side, one wheel, 20 feet in diameter, is placed directly at the stern, athwart ships, and by its revolutions pushes the boat ahead. These boats are not remarkable for their speed, but answer in narrow and shallow streams. The regular steamers have their main decks within four or five feet of the water, and the guards overhanging the bow give them the appearance of a New York ferry-boat. The paddle wheels are generally much further aft than in the eastern steamers. The after part of the main deck is devoted to freight. Above the main deck from 10 to 18 feet is the saloon deck, which extends nearly over the whole of the main deck. The saloon is surrounded with state-rooms, which open into it, as well as on to a promenade which goes entirely round the outside of the boat. The saloon is from 150 to 250 feet long. Above this deck is a promenade deck, upon which is a long tier of state-rooms, and this, in its turn, is surmounted by another promenade deck, which has the pilot-house at its front, and which is usually 50 feet from the water. But formerly, when there was no restraint upon reckless steam pressure, or the explosive qualities of the boiler, its *height*, as well as that of the decks, was very uncertain. The "crack boats" are now built from 300 to 400 feet, with 36 to 40 feet beam, eight feet hold, and draught of water, light two feet, and loaded four feet. These steamers are now free from those reckless races which formerly so endangered life, when the safety-valve was fastened down, the furnace stuffed with tar and pitch, and the captain, rifle in hand, ready to shoot down the pilot of the opposing boat at the critical moment when the least deviation in steering would lose him the race. Those barbarous times have passed with the frontier manners of the passengers. Their sporting, drinking, gambling, fighting, have given place to business, temperance, prudence, and refinement, while wealth rolls up in the cities as a result of the speedy and cheapened transportation which the steamers have effected.

The increase of steam tonnage on those waters, has been as follows:—

	1842.	1851.	1860.
New Orleans	28,153	34,736	70.072
St. Louis	14,725	31,834	55,515
Cincinnati	12,025	24,709	23,136
Pittsburg	10,107	16,943	42,474
Louisville	4,618	15,181	29,037
Nashville	3,810	3,578	5,268
Wheeling	2,595	7,191	11,545
Vicksburg	..	938	..
Memphis	..	450	6,143
Galena	..	..	5,849
Total tons	76,033	135,560	249,039

It is a matter of course that when the speed of these vessels has increased in the manner indicated, their efficiency for traffic has progressed in the same ratio. In the 25 days that were formerly required to go from New Orleans to St. Louis, a steamer of the present day will make eight passages, and will carry more freight. Hence, the number of tons does not indicate the growth of the trade. If the number of tons is three times greater, the business is 30 times larger. The effect of the great reduction in the freight on goods may be illustrated by a single example. Thus, in 1815 cotton cloth was 30 cts. per yard, and 100 yards weighed 25 lbs., which would consequently be worth $30. The transportation of this at that time from New Orleans to St. Louis would cost $5, or 17 per cent. of the cost. The same quantity of cloth is now worth $9.00, and the transportation from New Orleans to St. Louis 40 cts., or 4½ per cent. of the cost. These figures speak of the greater money value realized for products, and the increased quantities of merchandise procured for that money value.

The war of 1812, by interrupting trade on the Atlantic, had induced a large migration to the west, when steam was opportunely developed to facilitate trade and traffic at the same time. The return of peace found a large population west of the mountains in the full tide of prosperity, and in the Atlantic states great excitement in regard to steam, with multiplying manufactures, which sought a market in the growing west. Under such circumstances the old canal projects for opening up the communication were revived in full force, the more so that the war had nearly destroyed the usual water communication.

Instead of transporting merchandise in sloops and schooners along the coast, now no longer safe from the enemy, recourse was had to wagons over roads not the best in the world. This was necessarily very slow and costly. The traffic between New York and Philadelphia, for instance, was carried on in a Conestoga wagon, drawn by four horses, and that which covered the distance of 90 miles in three days was known as "the flying machine," and the value of goods at either end of the round showed great fluctuations, enhanced by the expense. This extra expense for the whole coast alone, it was asserted, would have paid the whole cost of a system of internal navigation from Maine to Georgia. It was then that the enterprises to which the great minds of the Revolution had given birth at the peace of 1783 began to be realized, and two objects were sought, viz.: a safe inland water communication along the whole Atlantic border, to operate in case of war, and another was to connect the waters of the west with the east, and the public began to regard with more favor the project of uniting the lakes to the Hudson river. Mr. Morris, who had suggested it at the close of the Revolution, wrote an able report in its favor in 1812, when the war gave new interest to it. The undertaking was formidable, and New York applied to the federal government and other states for aid, but her application was met with jeers and ridicule. The result was the determination of the state to undertake it alone, when the return of peace allowed of more facility for its execution; accordingly, on the 4th of July, 1817, the Erie canal was commenced with great ceremony, Governor De Witt Clinton turning the first earth, and it was completed October, 1825. The event was celebrated with the greatest pomp along the whole line, and in the city of New York. The canal is 363 miles long, 40 feet wide at top, 4 feet deep, and the capacity of boats, 80 tons. The construction cost $7,143,789, or $19,679 per mile. This immense work gave the long-wished-for communication between the great lakes and the tide waters of the Atlantic. In the same year, viz., October, 1817, a canal connecting the waters of Lake Champlain with the Erie canal some miles from Albany was commenced. This Erie and Lake Champlain or Northern canal is 63 miles long, and was completed at the close of 1823, at a cost of $1,257,604, or $19,962 per mile. The Erie canal proved to be the most successful work of the kind in the world, and within 10 years discharged in full the debt created for its construction. The great success of the work not only gave an impulse to canal building in other states, but induced the state of New York to embark in new undertakings of the same nature, which have not proved so successful. These were what are called the lateral canals, draining the country on either side, into the grand canal. The Oswego canal runs 38 miles from Lake Ontario to the Erie canal, at Syracuse. It cost $55,437, and was finished in 1838. The Cayuga and Seneca lake runs 23 miles from those lakes to the Erie canal at Mon-

tezuma, and was finished in 1829, at a cost of $237,000. The Chemung canal, connecting the Chemung river with Seneca lake, 39 miles, was finished in 1838, at a cost of $316,000. The Crooked Lake canal, 8 miles, was finished in 1836, for $120,000. The Chenango connects the Susquehanna at Binghamton with the Erie canal at Utica, 96 miles, and was finished in 1837, at a cost of $2,417,000. These canals never paid their expenses, and became a burden upon the revenues of the Erie. There are also in New York, the Genesee Valley canal, 108 miles; Black River and feeder, 87 miles; the Delaware and Hudson, 83 miles; and the Oneida, 8 miles.

The great success of the Erie, as we have said, roused the emulation of other states, and during the five years succeeding the opening of the Erie the air was filled with canal projects, only to name which would occupy much space. We may mention some of the most extraordinary, however: a canal from Boston to Narragansett bay; Long Island to Canada, *via* the Connecticut river; Boston to the Connecticut river; a canal over Cape Cod; Providence to Worcester; a ship canal across Central America. These projects only indicate the extraordinary activity that the Erie success had imparted to the public mind. Those which were evidently the most needed for present and future commerce, were immediately undertaken. The Chesapeake and Ohio, to connect the waters that the name designates; the Ohio canal, to connect Lake Erie with the Ohio river; the Farmington canal, in Connecticut, afterward used for a railroad site; the Chesapeake and Delaware, to connect those waters, were all ready, and broke ground July 4, 1825, three months before the Erie was finally completed. These works, with many others, which we shall take up in their order, were pushed to completion, under various difficulties, inasmuch as that they required a large amount of money, but they had an immense influence upon traffic, and called into requisition an amount of engineering skill which had never before been demanded in the country, and various success has attended the construction. The object of a canal is, of course, to float boats that contain merchandise, between two points, in order to reduce the expense of the transportation. The canal is therefore constructed with some regard to the amount of business that will be required of it. The channel must be excavated on the level soil, carried over gaps and rivers by embankments that will hold the water, and it must be fed by abundant streams.

The channel is excavated with the two sides sloping at the same angle, which varies with the nature of the soil. The base of the slope is commonly to the height as 5 to 4. The bottom of the canal is generally the breadth of two boats upon the deck, in order that they may pass. The depth of water in the canal should be at least one foot more than the draught of the boats. The towpath is about two feet above the level of the water, and about ten feet wide. When the canal runs through a sandy soil, or one that does not easily retain water, the bottom is "puddled." This process is to mix clay well with gravel and put it on in successive layers of two or three inches thick. When a new layer is put on, the old one is roughed up to make both adhere well. When repairs are needed, they are generally done at the time the water is let out for the winter. The bed of the canal is so laid as to give a gentle current to the water. The levels are the distances between the locks, and each level, proceeding downward, has a less elevation than the preceding one. In a hilly country these locks are frequent, and in some cases are continued for a distance, like steps up and down a declivity. Thus the Erie canal, on leaving Lake Erie at Lockport, descends 60 feet to the Genesee river. To perform this, ten double locks built in masonry are required, but the canal has also one level of 63 miles without a lock. The lock is a chamber built of timber or masonry, as large as possible for the size of the canal. The boats must not exceed what can be admitted to the locks. The top of the lock is above the surface of the water, and its bottom is level with that of the next lower level. Each end of the chamber is closed by heavy swinging doors, which open in the middle against the direction of the current. The doors being a little broader than the lock, they meet in the middle at an angle, and the weight of the water presses them together. When a boat going up the canal comes to a lock, it passes between the open gates, which close behind it. The water is then let in from the upper gates, until the lock being full, the boat floats to the upper level, generally about 10 feet rise, but sometimes 18 feet. It passes out, and another boat being ready to go

down takes its place, when, the upper gates being closed, the water is let off below and the boat lowers with it to the lower level. A lock full of water is thus discharged. It follows that a large supply of water must be had to replace what thus passes off, in addition to leakage and evaporation. The engineer of the Erie canal calculated the loss by leakage was 100 cubic feet per minute. For supply, reservoirs are often constructed. Canal branches, called feeders, are made to bring water from distant sources. Steam power is also used to raise water to the required level. This is the case with the Illinois and Michigan canal; the waters of Lake Michigan being pumped up to the summit level. In some cases inclined planes are substituted for locks. In these cases the boats run upon trucks, which are then, by the power of steam, dragged up the plane to the higher level. In the Morris canal, of New Jersey, these have a slope of one in 21. These are the general features of all the canals, but the influence they have upon transportation depends, of course, in some degree, upon the localities and the capacities of the work. Boats are commonly towed upon a canal by horses. A single horse can draw upon a good road a ton at a speed of 2½ or 3 miles per hour, and can draw as easily 70 tons upon a canal at the same speed. The difference in cost is immense. Instead of 24 cents a ton for one mile land carriage, the Erie canal charges 6 mills per ton per mile, or one-fortieth part of the expense. The freights charged are distinct from the state tolls. It is obvious that where the boats are of greater capacity, allowing of a larger quantity to be passed down at the same passage, the cost of transportation is much diminished. Thus the Delaware and Hudson canal had a capacity for 50 ton boats, and coal was carried 108 miles for $1. The enlargement of the canal so as to admit boats of 100 tons reduced the cost 65 cents, but some of the boats carry 148 tons at proportionate rates. When the routes of the canals of other states threatened to affect the business of the New York canal, the reduction of the cost by means of enlargement was the means resorted to to retain the trade, and the enlargement has been prosecuted at great expense. The principle of the enlargement was based upon the fact that as the canal is abundantly supplied with water, the only limit to its capacity would be the time required to pass boats at the locks. It was calculated that 26,000 boats can be locked each way in a season. The old canal boats were about 70 tons, hence the utmost capacity of the canal would be 3,640,000 tons; but by the enlargement the boats were to be of 224 tons burden, hence the tonnage would be 11,648,000 tons, if the quantity moving each way was the same, but the down freight is as four to one of the up, which reduces the capacity to 7,230,000 tons. Before the canal was built, the expense of transportation from Buffalo to New York was $100 per ton! and the time 20 days. A ton of wheat in New York was then worth about $33, hence the transportation was three times the value of the wheat, six times the value of corn, and twelve times the value of oats. As a consequence, the wheat of western New York at that time went down the Susquehanna to Baltimore as the cheapest and best market, as the lumber of the head waters of that river now goes. When the canal was opened, the freight down was about $14 per ton, more or less, according to the character of the freight. This has gradually been reduced, and in 1850, when the railroads for the first time were allowed to carry freight, it was $3 to $7 from Buffalo to New York. By the enlargement it is supposed the rates will be reduced to $1.82 between Albany and Buffalo. Since the permission of railroads to carry freight, however, the business of canals is more confined to those heavy freights furnished by the raw produce of the country, lumber particularly. Those coarse and bulky articles that are of low money value as compared with their weight will continue to move upon canals, but the lighter and more costly, as well as those pressed for time, will be carried exclusively by rails. These latter have some disadvantages, however, as in the case of flour, the motion of the railroad causing it to waste, an objection not urged against canal travel.

The total length of the five great lakes is 1,555 miles, and the area 90,000 square miles, and they are estimated to drain an area of 335,515 square miles. That vast tract of waters was a waste as far as transportation went until the year 1797, when the first American schooner was launched. The craft increased to some extent for the small commerce that engaged the settlers when there was no outlet either to the Atlantic

or to the south. In 1816, however, a steamer was built on Lake Ontario, and in 1819 the Walk-in-the-Water, 340 tons, was launched at Buffalo. The most of the trade, however, consisted in the operations of the Indian traders, carrying westward supplies and trinkets for the trade, and returning with furs and peltries. On the opening of the Erie canal, in 1825, a new state of things presented itself. Western New York threw off its frontier aspect, and put on an air of civilization, since it became a receiver of western produce and exporter of goods. The steam tonnage multiplied to transport the growing produce of the west. In 1822 the Superior was launched, another steamer in 1824, two in 1825, and three in 1826. One of these made the first voyage upon Lake Michigan, in 1826, on a pleasure excursion. It was not until 1832 that business called them thither, and then one reached Chicago, in the employ of the government, to carry supplies for the Black Hawk war. From that time, tonnage has increased as follows:—

	1841.	1850.	1860.
Buffalo Creek	6,773	25,990	42,640
Presque Isle	2,813	5,691	1,471
Cuyahoga	1,855	6,418	22,597
Sandusky	..	..	360
Miami	887	1,745	..
Detroit	2,053	16,469	30,381
Mackinaw	..	1,746	617
Chicago	..	652	8,151
Milwaukee	..	..	2,026
	14,381	58,711	108,243

The 11 boats running in 1833, carried to and from Buffalo 61,485 passengers, and the fares with the freight amounted to $229,-212. Those were the years of the great land speculations, and crowds of passengers went west on that errand. Three trips were made a year to the upper lakes. The trips to Chicago from Buffalo occupied 25 days to go and return. In 1841 the time required for a first-class steamer was 10 days from Buffalo to Detroit and back. This was reduced in 1851 to 3 days, and 5 for propellers. In 1834 the lake commerce was controlled by an association, owning 18 boats. This association was kept up to 1841, when the number of boats had increased to 48. The opening of the Ohio canals had poured upon the lakes a large amount of produce. The 500 miles of canal then completed, opened up the grain country to the lakes. In 1835, Ohio exported by the lakes 543,815 bushels of wheat; in 1840, 3,800,000 bushels; and in 1851, 12,193,202 bushels, which paid $500,000 freight and charges. The railroads have since interfered to some extent, but the wheat received across the lakes has this last year been as follows:—

From Ohio	2,856,216	bushels.
" Indiana	3,219,225	"
" Michigan	2,117,970	"
" Illinois	12,195,195	"
" Wisconsin	5,447,766	"
" New York	130,667	"
Total	25,967,039	"

The successive opening of the Ohio canals in 1833, the Illinois canal in 1848, and the Indiana canal in 1851, all added constantly to the amount of produce to be transported, and since the last-mentioned date the railroads have opened new regions of country, and increased the lake trade. It is to be borne in mind that the size of the vessels, their great speed when under way, and the greater dispatch in loading and unloading by steam, not only for motion, but for labor at the dock, enable the same quantity of tonnage to do ten times the business that it formerly could do. In 1859 the lake steamers averaged 437 tons. In the present year the average is 680 for steamers and 470 for propellers. A change is now going on in the power, by reason of the improvements in propellers. In 1843 the first lake propeller, the Hercules, was launched at Cleveland, 275 tons, the screw of Ericsson's patent. She was said to have made great economy in wood for fuel. In 1851 the propellers had increased to 52, with a tonnage amounting to 15,729. In 1860 there were 118, tonnage 55,657. These boats had far less speed than the paddles, but they have not ceased to gain in public opinion, not only upon the lakes, but in the Atlantic bays and rivers, until recent improvements have brought them to rival the paddle wheels in speed. These vessels will in all probability monopolize the European, as well as the internal trade.

Previous to the opening of the Erie canal, in 1825, the commerce of the lakes was necessarily local, since there were no markets east or west. The produce raised in the country bordering the lakes descended the streams that ran into them, and found interchange with other lake ports. The opening of the canal immediately gave an eastern current to produce of all descriptions, and much had ac-

cumulated in anticipation of the event, and goods returned in great quantities. In the month of May, 1825, 837 boats, carrying 4,122 tons of goods, left Albany for Buffalo, paying $22,000 tolls.

The lumber from western New York and the lake borders being now marketable where before it was valueless, a motive for clearing land was imparted, and the new canal received on its bosom from all sections of the lake shore the lumber brought by multiplying vessels. The lumber that found tide water before had been that which in southern New York and in Pennsylvania skirted the natural water-courses, and being cut and hauled, was rafted down to Philadelphia and Baltimore. The New England streams delivered the lumber in the same manner. The opening of the canal brought into competition the vast and hitherto untouched resources of the west, and the same remark applies to all farm produce. The farmers of New England were undersold at their own doors, by produce from western New York. The potatoes that had been quick of sale at 75 cents, were supplanted by the best "chenangos" at 37½ cents, and the competition was felt in corn, flour, and most articles. The effect of this was to turn the attention of that hard-working and thrifty race of men, the farmers of New England, to the western country, where the soil was so much more profitable. At that date commenced the interchange of inhabitants, which has drawn off so many New England farmers, replacing them with manufacturers from abroad. In order to show the extent of this operation, we take from the census of 1850 the figures showing the nativities of the whole people of the United States. Thus there were in the whole Union 8,370,089 persons who were born in the New England and middle states. Of these, 6,941,510 lived in the states where they were born. The remainder, 1,428,579, were living mostly west, but in their place there were living in the New England and middle states 1,292,241 persons who were born in foreign countries. These latter worked in the mills and manufactories, while 1,428,579 northern persons who had migrated west were agriculturists attracted thither by the fertile lands made available by the means of transportation. The lakes were now connected with tide water, but the whole system of western rivers with a southern course had no northern connection. The state of Ohio determined to make the connection, by means of a canal from Portsmouth, on the Ohio, to Cleveland, on Lake Erie. On the 4th July, 1825, the first spade was put into the ground, and in 1833 the first boat passed through from lake to river, 307 miles. The whole interior of Ohio was thus opened to either the northern or the southern market; and the state authorized turnpikes and other roads to feed the canal, on the borders of which trade grew rapidly. There are several branches of the Ohio canal; one, the Hocking, goes to Athens, and another to Columbus. The highest level of the Ohio canal is 305 feet above the lake, and 499 feet above the Ohio river. Another canal, the Miami, was also commenced in 1825 to connect Cincinnati with Lake Erie. In 1829 it had been opened to Dayton, 85 miles, but it was not completed until 1843, when it connected, 130 miles, with the Wabash canal, which joins Lake Erie at Toledo, making 215 miles from Cincinnati to Lake Erie. All the Ohio canals are as follows:—

	Length. Miles.	Cost.
Ohio canal	340	$4,695,202 69
Miami	85	1,020,000 00
" extension	130	3,667,440 82
Muskingum	92	1,628,028 29
Hocking	56	975,481 01
Wabash and Erie	91	3,009,923 29
Walhonding	25	607,268 99
Total	819	$15,603,345 09

Thus Ohio was crossed by canals, that gave the greatest development to her resources, and a new route was opened for all the western waters to the Atlantic; an interior transit from the Atlantic cities to all those of the east was in operation; and New Orleans might now be reached from New York and New England, by an internal route, with comparative ease and safety.

The state of Pennsylvania next undertook the great work of forming a connection between the Delaware and the Ohio. The project which had been formed at the close of the last century was now resumed; and in 1826 a law was passed to construct the work at the expense of the state, and, July 4th, 1826, the first earth was turned at Harrisburg, and in 1834 it was opened for use. The line consisted of a railroad, 82 miles, from Philadelphia to Columbia, cost $3,330,127; a canal from Columbia, 172 miles, to Hollidaysburg, cost $4,594,146;

a portage railroad across the mountain from Hollidaysburg to Johnstown, 36 miles, cost $1,634,357; and a canal from Johnstown to Pittsburg, 105 miles, cost $2,823,-192—making 395 miles, at a cost of $12,-381,822. Thus the Ohio at Pittsburg was now connected with Philadelphia, by a route much less than from Buffalo to New York. There were seven branch canals made to feed this. The aggregate length was 314 miles, and the cost $6,471,994. Every part of the state was now more or less in communication with the great outlets east and west. There were, besides, three private canals, viz.: the Schuylkill, 108 miles; the Lehigh, 85 miles; and the Union, 82 miles, which connected the great coal fields with tide water.

We have shown that Washington presided, at the close of the Revolution, at a meeting for the improvement of the Potomac. The ideas then suggested ripened into a project for a canal. The cession of a portion of Maryland and of Virginia to form the District of Columbia as a seat of government led to the national desire to connect it with the west. This was done, as we have seen, by the National or Cumberland road to Wheeling. But in 1820 the canal from Georgetown to Pittsburg was projected, Congress voting $1,000,000. Washington City issued bonds for a like sum. Georgetown and Alexandria each subscribed $250,000, Maryland $500,000, and Virginia $250,000, and 6,084 shares of $100 each were taken by individuals, making altogether $3,854,400. As the work was to run through four territories, it required a charter from Congress, Maryland, Virginia, and Pennsylvania, and July 4th (Fourth of July is a great day for canals), 1828, John Q. Adams and Charles Carroll turned the first earth. In 1834, 104 miles had been completed. The work was finally carried 191 miles to Cumberland in 1840, at an expense of some $16,000,000. It will not probably be carried further, never having answered expectations, although of late it has had business from the Cumberland coal regions.

Thus of the three great projects for connecting the eastern and western waters, only two were carried out. But, following the example of Ohio, both Indiana and Illinois determined to make a connection across their respective states, between the rivers on the south and the lakes on the north. But they were some years later than Ohio, since they were younger and weaker states. In 1836, under the spur of the speculative fever, Indiana enacted a bill authorizing a system of internal improvements. This embraced the Wabash and Erie canal, to run from Evansville on the Ohio to the Ohio state line, where it was to follow down the valley of the Maumee, taking up the Miami canal in its course, and entering the Erie Lake at Toledo. Second, the White Water canal, to connect the National or Cumberland road at Cambridge, with Lawrenceburg on the Ohio, 76 miles. Third, the White River canal, to connect Indianapolis with Evansville on the Ohio, 190 miles, and to prolong it from Indianapolis to Peru on the Wabash canal. There were also to be some Macadam roads and turnpikes. These works were to cost $10,000,000. The Wabash canal was begun in 1835, and in 1840, 90 miles were finished. The great revulsion then brought all to a stand, and some ten years elapsed before the work was completed through the aid of a loan obtained on pledge of lands granted by Congress in aid of this work.

The state of Illinois undertook a far more extensive system of public improvements. As early as 1810 a project was put forward, under the excitement of Fulton's great success, to connect New Orleans with Buffalo in 32 days by steam, by way of Chicago. The waters of the Illinois and the lakes were in high floods nearly blended. In 1823 a board of commissioners was appointed to report on the route and the cost. A grant of land was obtained from Congress in 1829 in aid. This was every alternate section of land, 10 miles on each side of the canal, in its whole length. Not until 1835 was an act passed to authorize the canal, in common with many other works, railroads or others, in a general system of internal improvements, which were to cost $12,000,000, and there had been sold of the lands granted by Congress $1,395,911.

The canal was to connect Chicago, at the foot of Lake Michigan, with the Illinois river, 102 miles. It was prosecuted with more or less vigor until the finances and credit of the state were ruined by the revulsion of 1837–9. The work then lay unfinished until in 1843, by means of a pledge of the unsold lands of the canal, a sum of $1,600,000 was borrowed, and the work completed in 1852. The sales of the land sufficed to pay off the new loan and some of the arrears.

We have thus sketched the great main canal avenues that connect important sections, and may enumerate them as follows:—

		Miles.	Expenditure.	Width. Feet.	No. of Locks.
Erie canal	Hudson river to lakes	363	$7,143,789	40	84
Pennsylvania canal	Delaware and Ohio	395	12,381,822	40	200
Ohio "	Ohio river and Lake Erie	307	4,695,824	40	152
Miami "	" " "	178	3,750,000	40	102
Indiana "	" " "	379	7,101,000	60	102
Illinois "	Lake Michigan with Illinois river	102	8,654,337	60	2
Total		1,724	$43,726,772		

The financial results of the New York canals may be thus stated in the aggregate of receipts and revenues from the commencement of the works to Sept. 30, 1859:—

Receipts.		Expenditures.	
Gross tolls	$70,565,737	Construction	$55,106,814
Loans	55,842,462	Repairs	16,932,080
Other items	20,469,924	Loans and interest	57,028,943
		Other items	17,790,286
Total	$146,858,123	Total	$146,858,123

These great state works have completed the connection between the Atlantic, the lakes, and the western rivers, and, by so doing, have promoted the circulation of the produce of all sections in active competition. The resources of every section have been drawn out in such a manner that the whole people have had the advantages of all. In the course of the development a vast capital was added to the national wealth, and a great value bestowed upon land not before very marketable. While this has been done by state means, a great number of other canals have been erected as well by public means as private enterprise. The most important of these was the Delaware and Raritan canal, connecting those two rivers. The work was completed in 1827, shortening the distance 16 miles between Philadelphia and New York, and packet propellers run regularly through it between the two cities. It is also the main source of supply of coal for New York. The state of Virginia early embarked in improvements, particularly in the James river, which is navigable to Richmond for vessels of 120 tons, the tide reaching there; above Richmond a series of short canals intended to connect the river with the Kanawha, where it is navigable 70 miles from its mouth on the Ohio. This project was undertaken by the James River and Kanawha Company, and was completed in the form of a canal, 147 miles, at a cost of $5,020,050. There are many other works of public utility in Virginia, under the control of a board of public works, chartered in 1816. There are a number of other canals in several states, as the Blackstone, of Massachusetts; the Ogeechee, of South Carolina, connecting Charleston with the Santee, cost $650,667, and many other improvements in a number of states. The Morris and Essex canal, of New Jersey, 101 miles, was completed in 1831. It had banking powers connected with it, and of all the public works in the country was the basis of the most stupendous stock speculation. Its liabilities were at one time near $10,000,000, and it was sold out in 1845 for a sum less than $3,000,000; its business is at present prosperous. It is one of the works that were erected to develop the great coal business of Pennsylvania. The discovery of that important mineral takes date about the year 1820, and the canals that were built to bring the coal down may be enumerated as follows:—

		Length. Miles.	Cost.	Width.	Locks.
Schuylkill navigation	Pennsylvania	108	$2,500,196	36	120
Lehigh canal	"	85	4,455,099	60	81
Susquehanna	"	41	897,160	40	12
North Branch	"	73	1,590,379	40	8
" " upper	"	94	4,500,000	40	..
Union	"	82	5,000,000	36	90
Delaware and Hudson	New York	108	9,100,000	75	18
Morris canal	New Jersey	102	3,612,000	32	29
					planes, 22
Total canals		693	$31,654,834		

The expenditure of large sums of money along the routes of these works for their construction promoted a local demand for produce, and aided in the settlement of the

country through which they ran, and from the improvement of which their future freightings were to be derived, and there is little matter of surprise that the first years of their operation should be of large promise. The cost of transporting a ton of merchandise from Buffalo to Albany, which had been $100, and the time twenty days, was at once reduced to $20, and the time to eight days. While yet they were being constructed, however, a new agent of transportation had risen, which was to overshadow their importance, and reduce them to a second rank. The rejoicing for the completion of the Erie had hardly died away, before the locomotive began to throw its shadow on the future. The "astonishing speed" of steamboats and stages was about to dwindle into an intolerable tedium. The capacities of railroads had begun to be discussed, and the discussion rapidly elicited action, which did not cease to extend itself, until the whole country has become covered with rails. When railroads began to be constructed, however, both vehicles, sailing vessels, and steamers had made considerable progress in speed, and the connections of travel had come to be made with more regard to dispatch. It is amusing to look back at some of the accounts of the wonders of the canals after the opening. Thus, in 1823 it is stated—

"CANALS! A *sloop*, called the Gleaner, has arrived at New York from St. Albans, in the state of Vermont, with a cargo consisting of 1,200 bushels of wheat and other articles. She will carry sixty tons of merchandise, and does not appear to have had any difficulty in passing through the northern canal. It is supposed that she will safely navigate the Hudson, and she is designed as a *regular packet* between St. Albans and the city of New York. *Look at the map!* An uninterrupted *sloop navigation* from one place to the other!

"When the Green Mountain vessel arrived at New York, the veteran artillery were ordered out, and she was saluted from the battery."

In 1824. "INTERNAL IMPROVEMENT. It is stated in one of the New York papers that a barrel of flour can be transported from Albany to New York, a distance of 150 miles, for 12½ cents, and that one individual offers to do it for seven cents."

In 1825. "MARCH OF INTELLECT WITH POWER.—It is no fairy tale, that flour, *manufactured on Lake Erie*, has been profitably sold in Newbern, *North Carolina*, for $5.50 per barrel. This flour was transported from the lake to Albany, through the Grand canal; thence down the North River to New York; and thence, by sea, to Newbern. The cost of transportation from the lakes to Newbern was less than $1.50 per barrel, while that between Raleigh and Newbern (not more than 120 miles) is generally two dollars."

In 1826. "The following, from the *Pittsburg Gazette*, shows the importance of canals. Mr. Foster has published in the *Greensburgh Gazette* a statement furnished him by a merchant of Meadville, showing the amount which the merchant paid for the transportation of his goods this fall from Philadelphia, *by way of New York*, the canal, and Erie, to the town of Meadville. The whole cost per hundred pounds was $1.20½! *We are now paying three dollars per hundred for carriage in wagons from Philadelphia to this city!*"

These extracts afford—in contrasting not only the routes, but the prices, with those before their use and those which now exist—much room for reflection. It may be remarked that the Caroline, burnt in the employ of the sympathizers in 1839, at Schlosser, and sent over the falls of Niagara, was built in South Carolina, and had passed up the canals to her destination.

CHAPTER III.

RAILROADS—LAND GRANTS—EXTENT AND COST.

THE excitement in relation to canals and steamboats was yet at its zenith, when the air began to be filled with rumors of the new application of steam to land carriages and to railroads. There were many inventions and patents at home and abroad in relation to carriages propelled upon common roads by steam, but these seem never to have attained much success, although attempts to perfect them are still made with great perseverance. On the other hand, the use of railroads from small beginnings has reached a magnitude which overshadows the wildest imaginings of the most sanguine. In 1825 descriptions came across the water of the great success of the Darlington railroad, which was opened to supply London with coal, and which had passenger cars moved by steam at the rate of seven miles per hour.

The most animated controversy sprang up in relation to the possibility of such roads in England, and was shared in to some extent on this side of the Atlantic. With the national energy of character, the idea had no sooner become disseminated than it was acted upon. The construction of railroads in America is usually ascribed to the emulation excited by the success of the Liverpool and Manchester railway. This appears not to have been the case, however, since some of the most important works in this country were projected and commenced before the Liverpool and Manchester road was built. The act of Parliament for the construction of that road was passed in 1826, and the road itself was finished and opened in September, 1830, 31 miles long; but the Massachusetts Quincy road, three miles from Quincy to Neponset, was opened in 1827, and a great celebration was held in consequence. The celebrated Mauch Chunk railroad of Pennsylvania was begun in 1826, and finished in the following year. On that road the horses which draw up the empty coal wagons are sent down on the cars which descend by their own gravity. This contrivance was borrowed by the Mauch Chunk road from the Darlington road, similarly situated, in England. It is to be remarked that both the Quincy and the Mauch Chunk roads were horse roads; the locomotive was not at first introduced. In 1828, twelve miles of the Baltimore and Ohio railroad were completed, two years before the Manchester road was opened. In the same year, 1828, the South Carolina road, from Charleston to Hamburg, was surveyed, and in Massachusetts the city of Boston voted the construction of a road from that city to the Hudson at Albany. The first portion of that road, however, Boston to Worcester, 44 miles, was not opened until 1835. The second road finished in the United States was the Richmond, Va., road, thirteen miles to Chesterfield, in 1831, and in the same year that running from New Orleans, five miles to Lake Pontchartrain, was opened. Thus roads were well adopted in public opinion here before the great success of the Manchester road was known, but which gave an undoubted impulse to the fever. During the excitement in relation to "rail" roads, a writer in a Providence paper thus satirized the condition of the Connecticut roads. He claimed the invention of the cheapest "rail" roads, and proved it thus: "Only *one* English engine *alone* costs $2,000, which sum the whole of our apparatus does not much exceed, as figures will prove; for 700 good chestnut rails at $3, amounts to only $21, and it ought to be remembered that this is *all* the expense we are at, and the inference is conclusive in our favor. We place our rails fifty to the mile by the side of the road, to pry out the wheels when they get stuck, and hoist behind when wanted." The public were, however, no longer to be satisfied with this kind of "rail" road. They embarked in the new enterprise with such vigor, that in 1836 two hundred companies had been organized, and 1,003½ miles were opened in eleven states. These were highly speculative years, however, and the revulsion brought matters to a stand.

It was at once apparent to the commercial mind that if railroads would perform what was promised for them, geographical position was no longer important to a city. In other words, that railroads would bring Boston into as intimate connection with every part of the interior as New York could be. The large water communication that enabled New York by means of steamboats to concentrate trade from all quarters, could not now compete with the rails that would confer as great advantages upon Boston. Indeed, Boston had now availed herself of steam power. Up to 1828 she owned no steamers. The Benjamin Franklin, built in that year, was the first, and her steam tonnage is now but 9,998 tons. When she bought her first steamboat, however, she was laying out those railroad connections that she has since pushed so vigorously, and they have paid an enormous interest, if not directly to the builders, at least to the general interests of the city.

It is to be remarked that the national government expended, as we have seen, largely in the construction of highways, the clearing out of rivers, and the improvement of harbors. The people have by individual taxes mostly constructed the earth roads of this country. The canals have, however, with a few exceptions, been state works, built by the proceeds of state loans, with the aid of lands donated by the federal government. These lands were made marketable and valuable by the action of the canals in aid of which they were granted. The railroads of the country have been, as a whole, built on a different plan, viz., by corporations, or chartered companies of individuals. These

associations have not, however, themselves subscribed the whole of the money, probably not more than half, but they have found it to their interest to borrow the money on mortgage of the works. The great object of the companies has not been so much to derive a direct profit from the investment, as to cause the construction of a highway, which should by its operation increase business, enhance the value of property, and swell the floating capital of the country by making available considerable productions of industry, which before were not marketable, since the influence of a railroad in a new district is perhaps, if not to create, at least to bring into the general stock more capital than is absorbed in its construction.

Thus in the last twenty-five years, a thousand millions of dollars have been spent in the construction of roads, and yet capital is proportionally more abundant now than before this vast expenditure, and land has, in railroad localities, increased by a money value greater than the cost of the roads! We have seen that before the operation of canals, land transportation was, and is now remote from these works, one cent per mile per hundred. If a barrel of flour is then worth in market five dollars, a transportation of 300 miles would cost more than its whole value; but by rail it may be carried from Cincinnati to New York for one dollar. Thus railroads give circulation to all the surplus capital that is created by labor within their circle. It is on this principle that may be explained the immense prosperity that has been seen to attend the enormous expenditure for railroads, particularly during the last ten years.

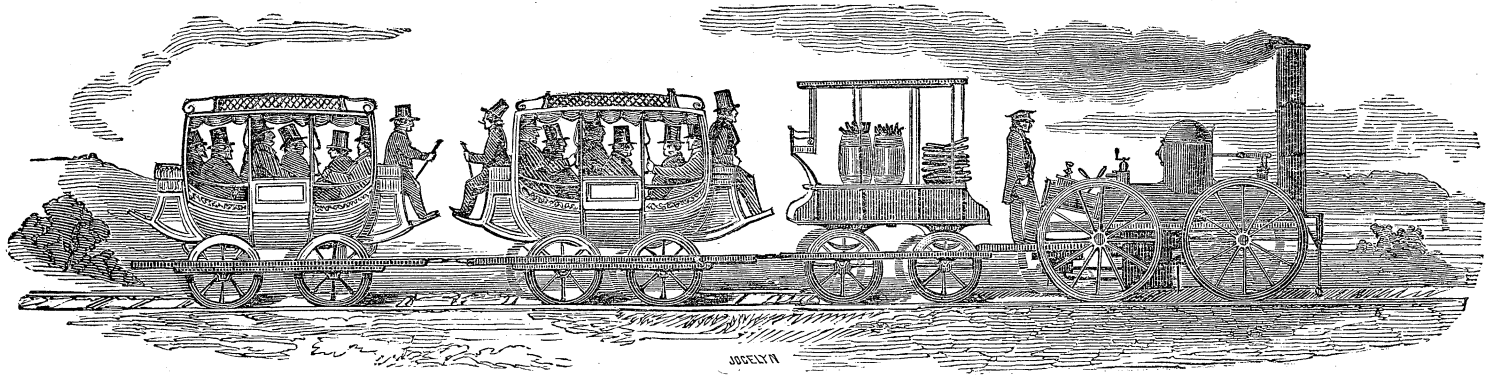
The construction of the Massachusetts Western railway, from Boston to the Hudson river, was one of the most important and financially successful of all the railroads of the country. New York had constructed her great canal, as it were making Albany basin a part of Lake Erie. Boston now grasped the idea of a railroad that should make Albany basin with its affluents a part of Boston harbor. It is to be borne in mind, however, that when that road was undertaken, railroad building was a new art; the mode of laying the track, the form, and even the model of rails were problems. The form of wheels to run on the rails, the mode of setting the car on the wheels, were all unknown compared with the knowledge on the subject which the construction of 30,000 miles of roads in this country has since accumulated. The state of knowledge at that time may be seen in the following extract from "Wood on Railroads" in 1825:—

"Nothing can do more harm to the adoption of railroads than the promulgation of such *nonsense* as that we shall see locomotive engines travelling at the rate of twelve miles per hour."

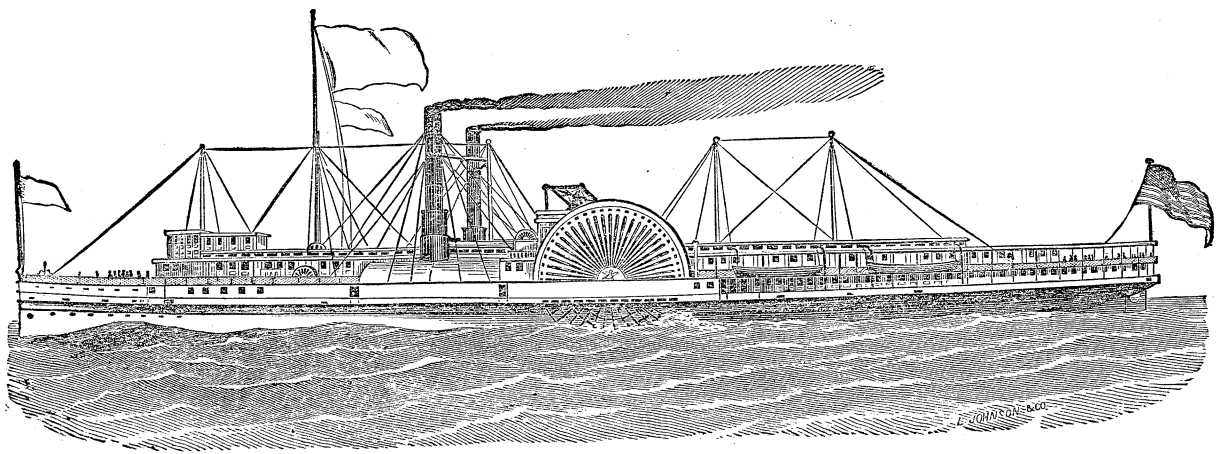
Such was engineering knowledge at the time Boston voted to build a connection 200 miles to Albany. Since that day much has been learned in relation to the characteristics of roads.

The great advantage of railroads is that they practically diminish distances between places in proportion to the speed attained. The rapidity of motion and power of traction depend upon the diminution of friction. This was sought in common roads, Macadam roads, and canals, but has approached perfection in railroads. The essential attributes are two smooth surfaces for wheels to run on. These being made of iron, are made as narrow as possible to lessen the cost; and to keep the wheels upon the rails, flanges are placed upon the inner rim of the wheel. The form of the iron rails has undergone many changes, as experience suggested improvements. The mode of laying these has also varied. The building of a railroad includes "the road bed," somewhat like a common road, and the superstructure, which embraces rails, supports, ties, etc. The main operations in the construction of the road bed consist in the "excavations, tunnels, embankments, ballasting, bridges, and viaducts."

These operations are required to give the necessary levelness and straightness to roads, both of which are requisite, not only as elements of speed, but of economy. The straightest road is the shortest; but when the road is done, the expense of keeping up the earth-work is nearly nothing, while, on the other hand, the annual expense required to keep up the perishable superstructure is very great and proportionate to the length of the road. Hence true economy requires a greater outlay to make the road straight, in order to avoid permanent cause of expense. Common roads may be lengthened to advantage, in order to avoid an ascent. In railroads this is avoided by tunnels through the obstacle when it is too high to excavate at what it would cost to tunnel. This is not, however, the only reason for straightening, since the frequency of curves greatly increases the danger of railroads.



FIRST LOCOMOTIVE EVER RUN ON THE MOHAWK VALLEY RAILROAD.



HUDSON RIVER STEAMBOAT.

When a car in motion enters upon a curve, it has a tendency to continue its straight course, and this is overcome by the resistance of the flanges of the wheel against the rail, and by the firmness of the outer rail. This resistance is always felt in the rocking motion of the cars, and is increased by the shortness of the curve. A pair of wheels is fastened to an axle and turns with it, the outer wheel moving on a curve much faster than the inner one, which would slide, under such circumstances, if both were of the same diameter, sufficiently to make up the difference. This is obviated by making the wheels conical, or of a larger diameter next to the flange than on the outside. The effect of this is that the wheels having some play between the rails, the outer wheel, forced against the rail, runs on a larger diameter than the inner one, thus compensating the speed. Further, to overcome the centrifugal force, the outer rail is made higher than the inner one, so that the weight of the car gives it a tendency to slide toward the inner one in opposition to the centrifugal force. The excavations in loose earth require to be supported at the sides by retaining walls, and to be drained by ditches and cross drains. In making a tunnel the centre of the road is set with great accuracy on the surface of the ground by an instrument, and shafts are sunk at proper levels along this line. The excavations are then made by "drifts" from shaft to shaft, and to the open ends of the tunnel. The material excavated is raised through the shafts, which serve for ventilation when the tunnel is finished. The embankments require great care to insure their solidity. When the materials for filling are at hand, they are usually made at their full height at one end, and then temporary rails permit the approach of wagons to be emptied over the head of the embankment. The progress of the work depends upon the speed with which these succeed each other. When the track passes through a country like a wooded swamp, where the materials for filling are not at hand, resort is had to trusses. Piles of a diameter of 15 inches are driven, so as to form lines of the width of the railroad; transverse ties are fastened across the tops, and, with proper supports, longitudinal timbers are laid across the piles to carry the rails. The tops of embankments and the bottoms of excavations are made about two feet below the intended or "formation level" of the road, and have there a convex surface like an ordinary road. This space of two feet is filled up with porous material, broken stones, gravel, etc. This is called "ballast," and through it the rains pass freely, and the frosts of winter do not so much affect it. On this "ballast" the sleepers are laid. Many roads are not properly ballasted, and are, therefore, unsafe. Bridges are difficult of construction, and have sometimes been made of iron. This was the case with the Erie railroad, when an accident occurred, because the iron, resting upon stone piers, contracted by the cold so as to drop off its support.

When the road bed is complete, the superstructure is put on. This is now done by cross sleepers. The best of these are second-growth chestnut, 7 feet long, and 8 by 12 inches. These are laid upon the ballast. The iron rails are laid upon these, but in some cases longitudinal timbers are first laid down, and upon these the iron rails are laid. The iron rails have undergone many improvements. At first, a simple flat iron rail was spiked down to these timbers. These rails would often get loose, and the end rising form a "snake head," and the wheel catching under, throw it up with great force and danger to passengers. These roads were ridiculed as "hoops tacked to a lath.". Various forms and weights of rail were adopted as experience directed; that now the favorite is called the T rail; the shape is like that letter inverted. There must be a certain breadth of rail for the wheel to run on, and depth for strength. The smallest rails will weigh 36 lbs. to the running yard. The Massachusetts roads use 60 lbs. to the yard; the New York roads, 70 to 75 lbs. to the yard. The rail is not fastened directly to the timber, but is held in chairs, which are spiked to the cross sleepers. The chair is of cast or wrought iron, and will weigh 20 to 30 lbs. They are made in one piece, so as to receive the ends of two rails, which are fastened by wedges of iron or wood, driven between them and the chair, without interfering with the longitudinal expansion and contraction of the rails.

The proper breadth of rails apart, or the width of the track, has been matter of much discussion. There are many advocates of the "broad gauge" and of the "narrow gauge." The latter is generally 4 ft. 8 in. and the former 6 ft. The Erie railroad is of the broad gauge, and the convenience of the cars is superior to that of the narrow

roads. It is a more expensive road to build, however. Both plans have their advantages. The majority of roads are, however, built on the narrow gauge. When gauges on long lines are uniform it facilitates the passage of the cars, which would otherwise be interrupted.

The power on railroads is mostly steam, but horses, stationary engines, and atmospheric pressure are sometimes used. The first really successful locomotive was built in 1814, which drew 30 tons 6 miles per hour; improvements have since been made until 70 miles per hour is attained. A Philadelphia engine drew 158 cars, 2,020 feet long, with 1,268 tons coal, 84 miles in 8 hours. The engine weighed 15¾ tons. The power of an engine depends upon the quantity of steam it can generate in a given time. Each revolution of the wheels corresponds to a double stroke of each piston, or four cylinderfuls of steam. The utmost heating surface is therefore required, and this is obtained by tubular boilers. Wheels, 7 feet in diameter, pass over 22 feet in each complete revolution. To go 25 miles per hour, therefore, they must revolve five times in a second, and each piston must make 10 strokes in the same time. This minute division of time is accurately made by this ponderous machine. This rapid exhaustion of steam causes a greater demand for fuel in proportion to the speed. The power of an engine to draw loads depends upon the pressure of steam, which is usually 50 to 60 lbs. to the square inch; but the adhesion of the engine to the rails must be great, otherwise the wheel would slip round. For this reason the wheels were first made with cogs to hold in the rail, but it was found that the weight of the engine was sufficient on level roads. The adhesion of iron upon iron is one-eighth of the weight, but in wet and freezing weather it is greatly reduced, and it lessens with the increase of the slope of the road, or ascending grade. Thus, if an engine will draw 389 tons on a level, it will draw but one-fourth of the amount up a grade 50 ft. to the mile. The average cost of locomotive power is not far from 50 cents per mile run, which includes fuel, oil, wages, repairs, wear and tear, etc. These expenses are, of course, lessened by levelness and straightness, since where these are perfect, more is carried for the same money, than on common roads. A great draw-back upon the cheapness of rail transportation is the weight of the rolling stock. The cars and engines usually are to the paying freight as 10 to 6. Various means have been proposed to lessen the burden of this expense, but hitherto without much success. It is evident from this slight sketch of the principles of railroad construction that the characteristics of a road, in relation to curves, grades, etc., have much to do with the economy with which it can be run, and its capacity to compete successfully with rival lines.

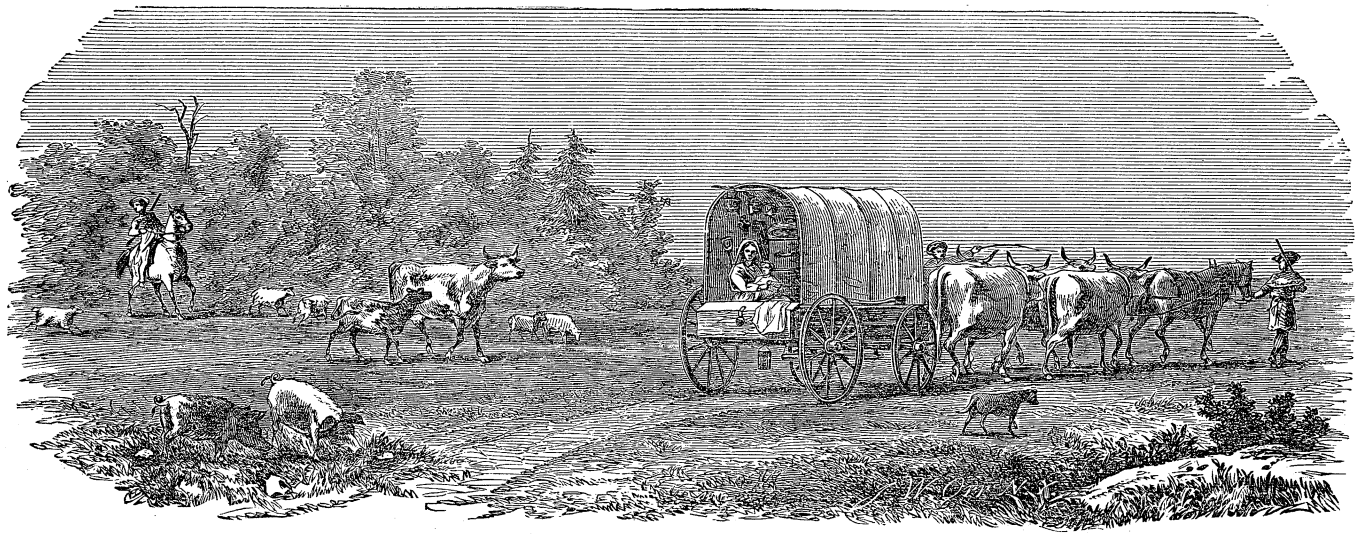
The city of Boston was, as we have said, one of the earliest to understand the advantages that were to be drawn from railroads in overcoming the disadvantages of its position in relation to the west, and the Western railroad has been the instrument by which she made the great states west of New York subservient to her interests. The charter of that road is dated March 15, 1833. The road runs from Worcester, 44 miles west of Boston, to the Massachusetts state line, and thence 38¼ miles over the Albany and West Stockbridge railroad, leased and operated by the Western road, into Albany, 200 miles from Boston. The first train of passengers that left Boston was on April 7, 1834, for Davis' Tavern, Newton, to which place the Worcester road was then opened. It was completed to Worcester July 3, 1835. The Western road, in continuation, was opened to Springfield Oct. 1, 1839, ten days before the United States Bank finally failed, and it reached Greenbush Dec. 21, 1841, thus establishing the route from Boston to the Albany basin in seven hours. It there connects with the New York Central road, which carries the line 229 miles to Rochester, whence, by the Lockport division of the Central road, 77 miles, it connects at Suspension bridge with the Great Western Canada road, and thence with the Michigan Central, the Illinois Central, and the Ohio and Mississippi roads to New Orleans. By this route Boston and St. Louis, 1,365 miles distant, are connected in 64 hours. From Buffalo the line connects south of the lakes with all the net-work of Ohio and other roads. Every portion of the country is thus brought into connection with Boston.

The Worcester railroad has a double track its entire length, laid with 60 lb. iron. Its freight-house at Boston is a single room 466 feet in length and 120 feet wide. The cost of the road was $4,843,610. The Western has a double track 68 miles; it has 20 depots, covering 118 acres of land; it has 15 stone-arched bridges, 15 to 60 feet span.

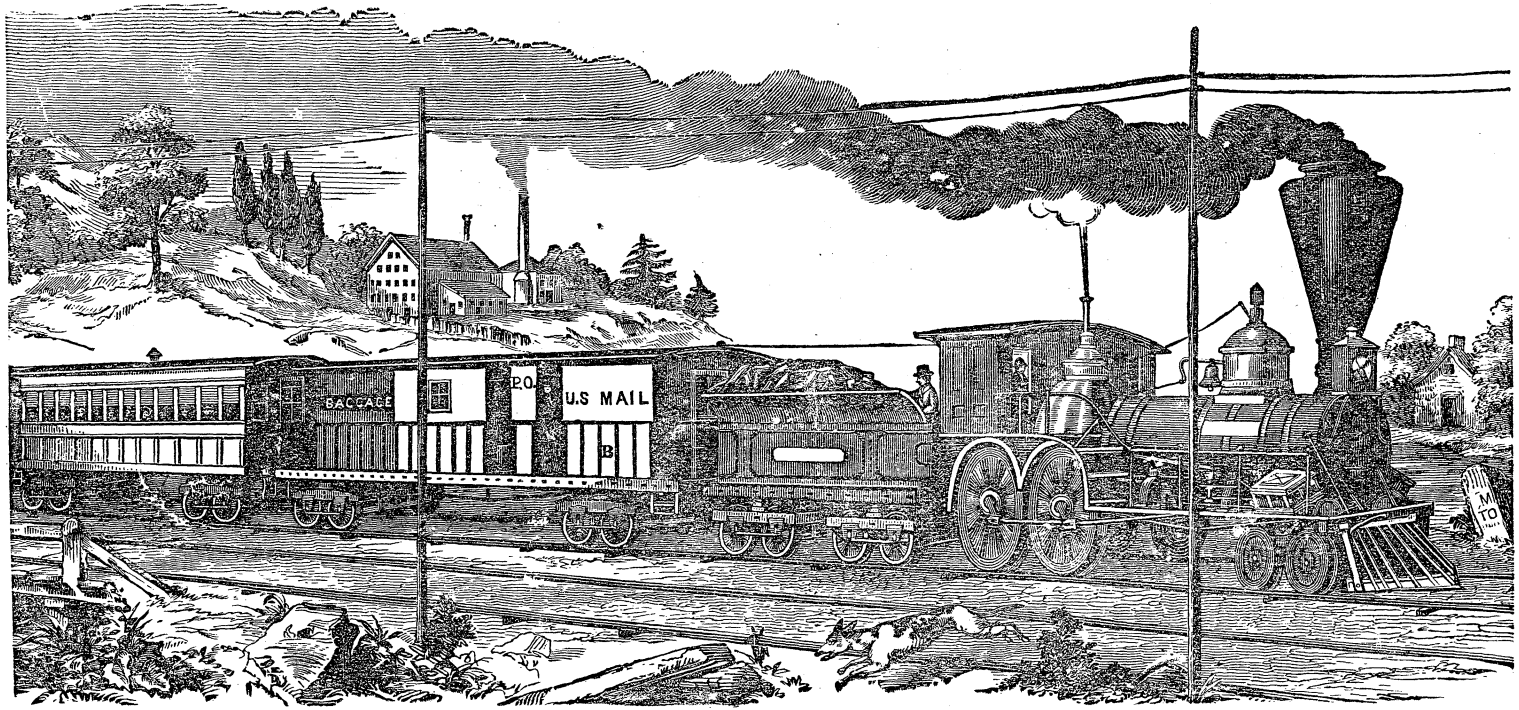
The bridge across the Connecticut is 1,264 feet long. The Western road has a grade of from 60 to 80 feet per mile for more than 18 miles; near the state line the depot is 1,456 feet above the depot in Boston! These features indicate the difficulties that were encountered in the construction, and it received much aid from the state. The original capital was $2,000,000; in 1836 this was increased, and the state subscribed $1,000,000. The state subsequently loaned its credit for $4,000,000. The present debt of the company is $5,839,080, and the capital $5,150,000, on which it uniformly pays 8 per cent. dividend. The cost of the Western road proper was $6,757,309, and of the Albany and West Stockbridge, $2,392,384. The opening of this road made a great change in flour business. Formerly the flour that came down the Erie canal, and was transhipped in sloops, made the voyage up the Sound and round Cape Cod, into Boston harbor. The Western road made the line direct, and by it about 600,000 bbls. now annually leave Albany; of this 40 per cent. is sold along the line, in what was once an agricultural region, and the balance meets in the Boston market the flour of the southern states. The Boston and Providence road was opened 41 miles in June, 1835, and at once became the connecting link between the steamboats from New York and Boston, taking the place of the stage lines. This road has now several branches, and has been very profitable. The original cost, $3,862,710, has long since been returned to its stockholders in 6 per cent. dividends. It has a debt of $195,220, which is paid at the rate of $30,000 per annum.

The Boston and Maine road, which is the second link in the great chain which reaches from Bangor to New Orleans by the Atlantic coast, 1,996 miles, was opened in 1843. It runs 74 miles to Berwick, where it connects with the Portland, Saco, and Portsmouth, extending to Portland. The cost of this has been $4,719,995, and it has no debt. It has, since Oct., 1843, paid 40 dividends, amounting to $133 per share of $100. The connections of this road are very numerous. Lateral and cross roads bring every manufacturing town in New England within easy distance of Boston. The 3,749 miles of railroad in the New England states give an active circulation to raw materials and the products of industry, making, so to speak, all the labor of those states available on equal terms.

In New York the question of railroads had been very early discussed. A publication of Colonel Stevens, of Hoboken, in 1812, advocated a railway instead of a canal to the lakes; but his proposition was opposed by Chancellor Livingston on grounds which indicate very odd ideas of the nature of the works. The first regular application to the legislature for a railroad charter seems to have been made by Stephen Van Rensselaer and others in 1826, for power to construct one between the Hudson and the Mohawk, and they received the grant for the reason that no railroads were then in the country at all, and that, as the petitioners were willing to make the experiment at their own cost, it was a good opportunity to permit it. The surveys for the road were not made until 1830, and the road was opened in September, 1831, and three cars, with twenty passengers in each, were drawn to Schenectady in 46 minutes by an American engine of 3½ tons. Meantime, the charters of the Harlem and the Saratoga and Schenectady had been granted. The opening of the Mohawk road caused much excitement. A road from the Hudson to the lakes was agitated, and applications were made to the legislature of 1832 for 49 roads, of which 27 charters were granted, and of these six have been constructed, viz.: the Brooklyn and Jamaica, Hudson and Berkshire, Erie, Rensselaer and Saratoga, Tonawanda, Watertown and Rome. In 1833, six railroads were chartered; of these the Utica and Schenectady, Whitehall and Rutland, and Buffalo and Black Rock were constructed. In 1834, ten railroads were chartered, and of these five were constructed: the Auburn and Syracuse, Buffalo and Niagara Falls, Long Island, Lockport and Niagara, and the Saratoga and Washington. In 1836, 43 railroads were chartered, seven of which were built: the Albany and West Stockbridge, Attica and Buffalo, Auburn and Rochester, Lewiston, Schenectady and Troy, Skaneateles, and Syracuse and Utica. In 1837, 14 railroads were chartered, but none of them have been constructed. In 1838, the state authorized a loan of its credit to the extent of $3,000,000 to the Erie railroad, and of $100,000 to the Catskill and Canajoharie, and of $250,000 to the Ithaca and Owego; also, $200,000 to the Auburn and Syracuse. In 1839, the Oswego and Syracuse railroad was chartered; and the city of Albany lent $400,000 to the Albany and West Stock-



EMIGRATING FROM CONNECTICUT TO EASTERN OHIO IN 1805, DISTANCE 600 MILES, TIME 90 DAYS, NUMBER OF PASSENGERS 10.



MIGRATING AT THE PRESENT TIME FROM CONNECTICUT TO IOWA, DISTANCE 1300 MILES, TIME 3 DAYS, NUMBER OF PASSENGERS 360.

bridge road. In 1840, acts were passed in the legislature to loan the credit of the state to the extent of $3,478,000 to six roads, and provision was made for a sinking fund to be paid into the treasury by the railroad companies, except the Erie. In 1841, the city of Albany was authorized to invest $350,000 in the Albany and West Stockbridge road. The Erie railroad, having defaulted on its interest, was advertised for sale by the comptroller, which did not take place, however. This was not the case with the Ithaca and Owego, which was sold for $4,500, and the Catskill and Canajoharie for $11,600. The loss to the state was $1,026,327. In 1844, the several railroads from Albany to Buffalo were, for the first time, permitted to transport freight on the closing of the canal, by paying the state the same toll as the canal would have paid. In 1846, the Hudson River and the New York and New Haven were chartered. In 1847, the seven roads making the line from Albany to the lakes were required to lay down an iron rail of 56 lbs. to the yard. They were likewise authorized to carry freight all the year by paying canal tolls; and all the railroads were made liable for damages in case of death by neglect of the companies' agents. In 1848, the general railroad law was passed. The law provides, however, that the legislature shall decide whether the "public utility" of the road justifies the taking of private property. This was removed in 1849. Thus, from 1826 to 1850, 151 charters were granted, and of these 30 have been carried into effect. We observe that the line from Albany to Buffalo was composed of seven distinct companies, finished at different times. Most of these were restricted as to fares. The Mohawk and Hudson—or Albany and Schenectady—was not restrained. The others were, as in the following table composing the line now known as the Central railroad :—

	Chartered.	Opened.	Maximum fare per mile.	Length. Miles.	Cost.
Albany and Schenectady	1826	1831	..	17	$1,711,412
Utica and Schenectady	1833	1836	.4	78	4,143,918
Syracuse and Utica	1836	1839	.4	53	2,490,083
Auburn and Syracuse	1834	1839	.5	26	1,011,000
Auburn and Rochester	1836	1841	.4	78	4,210,101
Tonawanda	1832	1842	.4	43¼	1,216,820
Attica and Buffalo	1836	1842	.3	31½	906,915
Total				327	$15,690,249

These companies were in 1850 allowed to carry freight without the imposition of the canal tolls, and in 1853 were all consolidated in a single company—the New York Central. When this project of consolidating was under consideration, the stocks rose rapidly to high premiums, and the principle of consolidation was to create scrip stock to the amount of the aggregate premiums, and divide this *pro rata* among the stockholders of all the companies. That scrip, to the amount of about $8,100,000, now figures as a part of the cost of the present company. It may be remarked that the restrictions as to charge have been inoperative, since the charge has always been less. The length has been shortened in such a manner that the distance is now 298 miles from Albany to Buffalo, and the charge is $7.00, or 2½ cents per mile, the time being 14 hours. The capital of the company is $24,153,000, the liabilities $6,233,000, and the $8,100,000 debt certificates to be paid out of future income—making altogether $38,486,000, against $30,732,517, the cost of the roads. The business of the new company from its consolidation has been as follows:—

EARNINGS FROM PASSENGERS, FREIGHT, AND ALL OTHER SOURCES, FOR THE YEARS ENDING SEPT. 30, 1853–1859.

Years ending	Passengers.	Freight.	Other sources.	Total.
Sept. 30, 1853,	$2,829,668	$1,885,572	$122,279	$4,787,519
" 1854,	3,151,513	2,479,820	286,999	5,918,332
" 1855,	3,242,229	3,189,602	131,749	6,563,580
" 1856,	3,207,378	4,328,041	171,928	7,707,347
" 1857,	3,147,636	4,559,275	320,338	8,027,259
" 1858,	2,532,646	3,700,270	295,495	6,528,412
" 1859,	2,566,369	3,337,148	297,330	6,200,848
Total				$45,733,296

Whoever glances at the map of New York will observe that the Erie canal runs mostly through the northern counties, skirting, as it were, Lake Ontario for a considerable distance; that the lateral canals extend from this toward the southern portion of the state. The Chenango canal connects the Mohawk with the Susquehanna, and the Genesee Valley canal extends from the Alleghany river to Lake Ontario. The great southern tier of counties bordering on northern Pennsylvania, after having taken great interest in the construction of the canal, were without means of communication with markets, other than by common roads. The face of the country was too rugged to permit of a canal, but in 1825 the state legislature ordered the survey of a state road from Lake Erie to the Hudson river. Several conventions were held during the four years ending with 1830 in relation to the road. The railroad fever had gained ground meantime, and finally, in 1832, a charter for a railroad was granted,

with a capital of $10,000,000. The survey was made by De Witt Clinton, Jr., but the legislature required that $1,000,000 of the capital should be subscribed before the work was commenced. This was subscribed, and E. Lord chosen president in 1833. A new survey was made at the expense of the state, and the report made on it in 1835, when a reorganization of the company took place, with J. G. King president. The subscription of capital now reached $2,362,100. The work was commenced by putting 40 miles along the Delaware river under contract. The great fire of December, 1835, incapacitated many of the subscribers from paying up, and work was suspended. In January, 1836, the legislature loaned its credit for $3,000,000, but the stock could not then be negotiated. Some work was done along the line, however, by local subscription. In 1840—Mr. Lord again president—the loan act was amended so as to be available, and the company purchased its iron. The terms of the loan permitted the state officer to deliver to the company $100,000 of state stock whenever he should have evidence that the company had expended an equal amount; the state stock not to be sold under par. The company then paid its contractors with time drafts. The receipts for these drafts furnished the evidence of the company's expenditure, on which the state officer issued the stock to the company, which then borrowed on it the money to take up the drafts, and the lenders of the money sold the state stock in the state for what it would bring—some lots as low as 80. The work thus done was in detached lots, as the interest of certain parties prompted the expenditure. As soon as the last issue was made by the state the company stopped, and the state assumed the interest on the $3,000,000 issued to it. In 1842 the company assigned, and its affairs fluctuated until 1844, when Mr. Loder was elected president. In 1845 the state surrendered its lien of $3,000,000 upon the road, and authorized the individual stock to be cut down one-half by holders giving up two shares and taking one new one. A new subscription of $3,000,000 was obtained, and the work commenced anew. Much of the old work was useless; and at this day, when the passenger approaches Dunkirk, he sees, stretching out far away to the right, like an immense army of grim warriors, the piles that were driven originally for the road, at great expense, and then abandoned. From the year 1845 the road began to grow. Starting from Piermont, on the North River, 20 miles above the city, it reached Otisville, 62 miles, in October, 1846. The route was altered, and reached Binghamton, 139 miles, in December, 1848, at a cost of $9,802,433, allowing $1,458,000 for half the old stock, after the release of the state lien. In June, 1849, 22 miles more to Owego were opened; in October 36½ miles were added to Elmira; and it finally reached the lake at Dunkirk, May, 1851. This was a single track, and it was found almost impossible to work it; consequently they put a second track under contract on portions of the road. It was now found that the location of the road at Piermont, to be reached by steamboat, would not answer. The company then made an arrangement with the Paterson and Ramapo road to allow the Erie to come into Jersey City. The Erie railroad being a wide gauge, 6 feet, and the Paterson road 4 feet 8 inches, it became necessary to lay another rail outside the track, to permit the Erie cars to come over that road, and the Erie cars reached Jersey City in November, 1853. It is remarkable in relation to this road, that it has depended upon the telegraph to such an extent that it could scarcely be operated without it. It gives constant information of the whereabouts of the trains and the condition of the track, so that the superintendent, wherever he may be, keeps up a constant communication with all the stations. The whole length of the road is 465 miles; 282 miles double track and sidings. The maximum grade of the road is 60 feet to the mile for 8 miles, and there is one of 57 feet to the mile. The cost of the road was greatly enhanced by the mode of raising money for its construction, by a constant series of loans, for which were issued first mortgage bonds, second mortgage bonds, bonds convertible in stock in 1862, bonds convertible in 1871, income bonds, unsecured bonds, and other debts, for very few of which the face was obtained, many of them being disposed of at a large discount. By these means the debts of the company ran up to $25,260,000, and the capital, $10,000,000, was in February, 1857, by a dividend of 10 per cent. in stock, money alleged to have been earned and sunk in the Long Dock, raised to the sum of $11,000,000. This load of debt exceeded the ability of the company, and it went finally into the hands

of a receiver. The length of the road is 446 miles, and it has a branch of 19 miles from Chester Junction to Newburgh, making 465 miles. It leases of other companies 95 miles, consequently operates 560 miles; and it has 282 miles of second track. There are 219 locomotives, 160 passenger cars, 49 second class cars, 45 baggage cars, and 2,763 freight cars. The company connected with Jersey City over the track of the New Jersey Transportation Company, but it projected an independent connection through what is called the Long Dock. This embraced a tunnel of 2½ miles through Bergen ridge, and 2½ miles of road running out on to docks and piers built out to deep water. The Long Dock Company was chartered by the state of New Jersey with a capital of $800,000. It purchased $773,440 worth of real estate. The Erie Company leased this at 10 per cent. of the capital, and then commenced expenditures on the tunnel, which is 4,880 feet long, and up to January, 1860, it had expended $1,500,000. This, among other causes, brought the Erie railroad to default; and in August, 1859, at the suit of the fourth mortgage bondholders, a receiver was appointed. It was then proposed, as a means of arrangement, to capitalize the unsecured bonds, with the interest for two years, into a preferred 7 per cent. stock; to extend the first mortgage bonds coupon to March 1, 1860; the second mortgage to September, 1860; the third to March, 1861, and the balance to December, 1861. It is estimated that the road will clear the other claims upon it, and complete the Long Dock. The business of this road from 1842 to 1859, inclusive, was as follows:—

RECEIPTS.

Receipts from passengers	$14,428,024
" " freight	29,902,826
" " mails, &c.	1,586,935
Total	$45,917,785

EXPENDITURES.

Operating expenses	$28,993,114
Dividends	3,481,445
Total	$32,474,559

The Camden and Amboy railroad and Delaware and Raritan Canal Co., of New Jersey, is one of the oldest passenger roads, having been chartered in February, 1830, with the canal privilege. The last is 43 miles from Bordentown to New Brunswick; and the former, South Amboy to Camden, New Jersey, 63 miles. There was to be no rival route within five miles of it. In 1831 the company gave the state 1,000 shares of stock, and a new act was passed consolidating the canal and railroad companies; fares not to exceed $3 between New York and Philadelphia. In the following year 1,000 shares more were conveyed to the state. In 1837 the road was permitted to extend to New Brunswick; fares limited to 5 cents per mile. In 1842 the transit duties on the road were fixed at 10 cents per ton for freight, and one-half of all above $3 charged for passengers. The road was opened to Camden in 1834. In 1843 an arrangement was made with the New Jersey Transportation railroad for through passage from New York to Philadelphia. The Camden road cost $5,563,580, and the New Jersey railroad, Jersey City to New Brunswick, 31 miles, $4,719,176. The Camden road has paid in 25 years 281 per cent. dividends, or 11¼ per cent. average.

The New Jersey Central road extends from Elizabethport, 12 miles by water from New York, to Easton, on the Delaware; at Elizabeth it connects, also, with the New Jersey railroad; at Easton it commands the great Pennsylvania coal fields, and, prospectively, it will unite New York city with Lake Erie, over the Pennsylvania and Sunbury and Erie railroads. The cost of the road is $5,617,290; the capital is $2,000,000; and the debt $3,375,000.

The great Pennsylvania line of improvements, from Philadelphia to Pittsburg, commenced 4th July, 1826, and finished in March, 1830, comprised 82 miles of railroad from Philadelphia to Columbia, and 36 miles of portage road from Hollidaysburg to Johnstown; this consists of a series of inclined planes, which are worked by stationary engines. This 118 miles of railroad was prolonged by 278 miles of canal, and the cost of the whole to the state was over $12,000,000. This broken line was not very well calculated to compete either with the continuous water service of the Erie canal or the uninterrupted passage of freight on the New York railways. The citizens of Philadelphia felt the want of works better adapted to the growing wants of that great city; and a new railroad was proposed from Harrisburg to Pittsburg, 250 miles. The route is favorable, except for the mountain division, where the summit is crossed, 2,200 feet above tide water, requiring gradients 95 feet to the mile. These are but little in excess of those

of the Massachusetts lines, which are worked to advantage. This work was opened through, November 15, 1832, at a cost of $7,978,000, It proved very successful, and up to November, 1855, its profits, over interest on capital, were, in accordance with its charter, credited to construction account, and it has since paid 6 per cent. The state line of public works did not succeed financially, and the state determined to sell it. After repeated offerings it was finally purchased by and transferred to the Pennsylvania railroad in 1857 for $7,500,000, which was met by an issue of the 5 per cent. bonds of the company to the state, payable, $100,000 per annum until 1890, and the balance, $4,300,000, in four equal instalments annually thereafter. When the road took possession of the state works, the canals were found to be in a dilapidated condition, and the railroad needed repairs, which required assessments. The route then became continuous by rail from Philadelphia to Pittsburg, 353 miles. From Philadelphia 8 miles to the Susquehanna river there is a double track, and other portions of the road raise the double track to 242 miles. The cost, including the state line, is $30,168,987, composed of capital, $13,240,225, and $17,571,054 of bonds. A part of the cost is composed of $816,050 advanced to the Pittsburg, Fort Wayne, and Chicago railroad, which prolongs the Pennsylvania road to the latter city. That road was composed of three roads, viz.: the Ohio and Pennsylvania, the Ohio and Indiana, and the Fort Wayne and Chicago roads. These were consolidated into one company in 1856, and the line completed from Pittsburg to Chicago in 1859, 471 miles, at a cost of $16,079,590, of which $5,259,040 is capital, and $7,956,075 bonds. To assist the completion of this road, the Pennsylvania Railroad Company took up the rails on the 36 miles of portage road which it had bought of the state, and which was of no use, as it run parallel to its own road, and gave them to the Pittsburg road to complete its extension from Plymouth into Chicago. For this iron and the expense of taking up and moving, the Pittsburg road gave its first mortgage bonds for $650,000. The business of the Pennsylvania road, connecting, as it does, Philadelphia with Chicago and the whole net-work of railroads between and beyond these cities, is not only profitable to itself, but of immense value to Philadelphia.

We have stated that a portion of the great Baltimore and Ohio railroad was finished two years before the opening of the Manchester road in England. The company received two charters: one from the state of Maryland, February, 1827, and the other from the state of Virginia in the following March, with authority to construct a road from Baltimore to the Ohio river. The capital authorized was $5,000,000, and the company entitled to organize on the payment of $1,000,000. The company was so organized in April of the same year, and with the aid of several officers of the United States topographical corps, the road was partly located in the same summer. July 4th, ground was broken by Charles Carroll, of Carrollton, and the portion of the road to Ellicott's Mills was put under contract. The capital of the company, at the close of 1828, reached $4,000,000, of which three-fourths was taken by individuals, $500,000 by the city of Baltimore, and $500,000 by the state of Maryland. The road was gradually extended to the Point of Rocks in 1832. Here arose an obstacle of right of way. The Chesapeake canal had appropriated the narrow gorge through the mountain, and several years of negotiation elapsed before the difficulty was finally settled by the legislature. In 1833 the Washington branch was chartered, on the condition that at least 25 cents per passenger should be paid to the state. The Baltimore and Ohio Company contributed $1,016,800 toward the construction, and it was opened 30 miles to Washington, August 25, 1835. The road had then no locomotives, horse power being used. The company offered $4,000 for a locomotive of American manufacture to burn coal. One was invented by Phineas Davis and accepted. It ran 15 miles per hour on short curves and 30 miles on a straight line. The rails were flat bars laid on stone foundations, which soon gave way to longitudinal timbers with improved rails. The road reached Harper's Ferry in 1834, and the state subscribed $3,200,000 for the extension to Wheeling. In 1838 the state of Virginia extended the time for construction through its territory and subscribed $1,058,420. The road was then completed to Cumberland in 1842, but nothing further was done until 1847. Virginia again extended the time, and in 1849 state bonds granted to the company furnished means for pushing the road to completion in 1853. The city of Baltimore then furnished $5,000,000, which was expended in protecting tunnels,

double track, etc. There is one tunnel of 4,137 feet, and the length of all the tunnels is 12,804 feet.

A charter for the Parkersburg branch was granted in 1851. The work began December, 1852, and was completed May 1, 1857. The road was built jointly by the city of Baltimore and the Baltimore and Ohio Company. The former gave $1,500,000 first mortgage bonds, and the latter $1,000,000 of its second mortgage bonds, and has since advanced $1,795,326. The road is operated by the Baltimore Company under a contract for five years, at a rent of 40 per cent. of the gross earnings.

The capital of the Baltimore Company is $10,011,800, and the funded debt $13,881,833. There are three sinking funds operating to redeem these debts, and all amount to about $1,200,000. The total earnings of the main road for 30 years were $9,744,351 from passengers, $29,604,970 from freight; total, $39,349,321; the amount, less expenses, was $17,421,250, and the total amount of dividends paid has been $4,589,866. These range from 1 to 7 per cent., and during the five years ending with 1852, were paid in stock.

The traffic of the road east is mostly in coal. Thus, of 566,214 tons delivered at Baltimore in 1859, 323,898 was coal. The number of passengers on the road and branches going west in 1859 was 338,037; going east, 349,501. Tons of freight going west, 303,104; going east, 770,452. This road has exercised an immense influence upon the business of Baltimore, and opened a route to the Ohio valley which rivals the Pennsylvania and the great New York routes.

The Virginia Central railroad, which now connects Richmond 195 miles with Jackson's River, was originally chartered, in 1836, as the Louisa railroad, with a capital of $300,000, and in 1837 the board of public works was authorized to subscribe on behalf of the state $120,000. In December, 1837, twenty-three miles of the road were opened. It was further extended in the following year, and in 1840 the road reached Gordonsville. Under new privileges, granted in 1848, the work was resumed, and reached Charlottesville in May, 1850, but in that year some new privileges being asked, the name of the road was formally changed to the Virginia Central railroad. There were then seventy miles in operation, and extensions at both ends were proceeded with; of these in 1851 twenty-three miles were completed, bringing the road into Richmond. It was not until 1857 that the road was opened through to Jackson's River, 195 miles, at a cost of $5,362,910; of this $3,132,445 is capital paid in, $1,878,493 by the state, and the balance by individuals. The highest grade of the road going west is eighty-three feet per mile for 1½ miles, and going east seventy-two feet per mile for fourteen miles. There are 107 miles straight, and 77 miles curved, of which the smallest radius is 716 feet for ¼ mile. The rails are all T, from fifty to sixty pounds per yard. The cross ties 2,400 to the mile. The business of the past year was as follows :—

Going	Passengers.	Freight. Tons.
East	33,629	66,678
West	30,548	68,205
Total	64,177	134,883
Earnings	$311,980	$306,212

This road from its opening, 1837, to the close of 1859, earned as follows: average length, 90 miles; passenger earnings, $79,583; freight, $89,773; gross earnings, $180,009; expenses, $94,486; dividends paid, $22,971; per cent., 2.

In casting the eye upon a railroad map, the line from Bangor, Maine, to New Orleans, 1,996 miles, is found to be composed of nineteen grand links; one of the largest of these is that which connects Lynchburg, Va., with Bristol, Tenn., 204 miles. This was called the Virginia and Tennessee. It was opened in 1854. By this route the mails of the government are conveyed from Washington to New Orleans in seventy-five hours. This commanding position of the road is not, however, more advantageous than its local business, which is derived from one of the most fertile districts of Virginia, as well as rich in minerals. The road opened what had been one of the most secluded portions of the central states, and vast resources are there to be developed. The cost of the road is $7,050,519, of which $3,418,599 is capital and $2,833,000 bonded debt. The future of this road is one of the most promising.

The next most important link in this great line is the Orange and Alexandria road, connecting Alexandria and Lynchburg, 170 miles. This road was completed in 1859; by it the distance from New York to central Virginia is shortened sixteen miles, and the route to New Orleans, so to speak, straightened. The cost of the road was capital, $1,899,330; bonds, $2,600,000.

The South Carolina road was one of the

first projected in the country. The city of Charleston early saw the advantage and importance of the work, which was commenced in 1830, and opened in 1833. Its main trunk extends from Charleston to Hamburg, on the Savannah river, opposite Augusta, Georgia, 136 miles. The track was originally a trestle-work, on which was laid a thin flat rail. Some of the swamps and rivers were crossed at an elevation of fifty feet. On this road the first successful American locomotive was run. It was called the "Best Friend," and was built under the supervision of E. L. Miller, of South Carolina. It was introduced by Horatio Allen, and ran in 1830, when there were but eight miles of road out of Charleston. The South Carolina road cost $7,701,338, of which $4,179,475 is capital, and $2,730,463 bonded debt. The road owes most of its business to the transportation of cotton, and it pays ten per cent. regularly. Its stock is above *par*. The project of connecting Charleston with Cincinnati was early entertained, and in 1836 a grant was obtained from South Carolina, North Carolina, Tennessee, and Kentucky, for the purpose of constructing a road through Columbia, Knoxville, and Danville to Covington, opposite Cincinnati. This enterprise was swamped in 1837 by the crisis, when the road was partially constructed to Columbia. That project has now been revived by the completion of the Greenville and Columbia road, and the extension of the Blueridge road into Tennessee, thence *via* Knoxville through Danville and Lexington to Cincinnati. A more circuitous road by way of Nashville and Louisville, over the Nashville and Chattanooga, and Nashville and Louisville railroads, has been opened. Charleston thus drains the whole interior country.

The Georgia railroad system is composed of two great lines: one from Savannah to the Tennessee river, 434 miles, and the other, 255 miles, from Augusta to West Point, whence it is prolonged to Montgomery by the Montgomery and West Point road. The Georgia Central, connecting Savannah with Macon, 191 miles, was opened nearly at the same time as the Georgia road connecting Augusta with Atlanta, 171 miles, viz., in November, 1843, having been commenced in 1836. It was chartered with banking privileges, and has been eminently successful. Its capital stock is $4,010,000, and bonded debt $158,767. This road made a dividend last year of 15 per cent., and its stock is now 15 per cent. premium. The Georgia road cost $5,210,372, of which $4,156,000 is capital, and $476,895 bonded debt. The earnings of this road are 15 per cent.

From Atlanta a road stretches to West Point; it has always paid either seven or eight per cent., besides several extra dividends; and last year divided a bonus of thirty per cent. The state railroad of Georgia, built at extravagant cost, and managed by state officials, paid into the treasury last year out of its net earnings about eight per cent. on its cost.

In Alabama, Louisiana, and Arkansas, their fine rivers, navigable for steamboats, and stretching into every part of the states, have made railroads almost unnecessary. But whenever they are built, and can obtain a freight of cotton, they are sure to pay. This product is not like corn, or wheat, or even flour, worth one, two, or three cents a pound, but eight, ten, or twelve cents, and can therefore afford to pay the cost of transportation.

The most remarkable railroad in the world as to extent, location, mode of construction, and magnitude of resources, is perhaps the Illinois Central road. It may be called the corner-stone of a future empire. In 1837, when the population of the state of Illinois was less than 200,000 souls, and these agriculturists scattered over the great state, they undertook with singular boldness a system of internal improvement by canal and railroad, which would involve an expenditure of at least $15,000,000. Among these was the Central railroad, which was to extend from Cairo, at the junction of the Ohio and Mississippi rivers, longitudinally of the state, to Galena at its northern extremity on the Missisippi river, making a line of 457½ miles, which should be the base of a triangle of which the great river formed the other two sides. This road was to cross the Illinois river at the commencement of navigation, or where it meets the canal coming from Chicago. Other roads were projected to cross the state, intersecting the Central road. The Central road was undertaken, and about $3,500,000 spent upon it, when bankruptcy overtook the state, and the road rapidly deteriorated. The progress of the work on the canal, with the funds borrowed on pledge of the land granted by the federal government, had been of great benefit to the state, and had enabled the federal government to sell most of its lands on the canal and great water-courses, in fact, all within reach of market. There remained,

however, some 15,000,000 acres of the richest land in the heart of the state, for which there was no sale, because it was not accessible to market. Experiencing, however, the great results from the canal grant, which not only laid open great tracts to market, but by local expenditure in construction, brought settlers and money upon the vacant lands, it decided upon a similar grant to the state in aid of the Central railroad. Accordingly, in September, 1850, Congress made a grant of lands to the state of Illinois of every alternate section, six sections in width, on each side of the road and its branches, and if any land so situated should be taken up, then any vacant land elsewhere might be selected in room of it, within fifteen miles of the line of the road. The same law conferred upon the states of Alabama and Mississippi similar grants for the extension of the road from Cairo to Mobile city. In the following February the state of Illinois incorporated the Illinois Central Railroad Company, with a capital of $1,000,000, to be extended to an amount not exceeding the cost of the road. The company on its organization was to pay over to the state treasury $200,000, and receive from the state the entire grant of lands made by the federal government, together with all that remained of the old Central road, right of way, etc. The company was to have fifty miles completed within two years, under forfeit of the $200,000 deposited, and which was to be returned to the company on the completion of the fifty miles within the time. The road was to run from Cairo to the western end of the Illinois canal, and thence branch to Galena on the river, and to Chicago on the lake. The company was to pay to the state annually five per cent. on the gross income of the road. These were the leading items of the grant, and the conditions were all carried out. The location and survey of the route showed the company entitled to 2,595,000 acres of land to be selected by the company. This vast tract of land, amounting to an area larger than the whole state of Connecticut, was all to be selected from good farming lands, not an acre of waste in the whole, but all of the richest prairie soil, of the same character as that in the neighborhood of St. Louis, which for two hundred years had given to fresh settlers annual crops, without in any degree deteriorating apparently. These lands of the company were appropriated, 2,000,000 acres, valued at $18,150,000, as a security for $17,000,000 of construction bonds; 250,000 acres were added to the interest fund to meet any deficiency of means from other sources appropriated to interest on the construction bonds; and 345,000 acres were held in reserve, but were finally the basis of $3,000,000 "free land bonds," issued and redeemed by conversion into company stock. The 2,000,000 acres were placed in the hands of trustees, who alone have power to give title to purchasers, and who are required, whenever the funds accumulate to the amount of a bond, to buy and cancel it. No land can be sold, unless bonds to the same amount are cancelled. It was estimated that the bonds thus issued would build the road, and leave the entire work free of cost to the stockholders. It was found requisite, however, to create 170,000 shares, representing $17,000,000 capital. On this instalments have from time to time been called in. The $200,000 deposited with the state was assessed $20 on 10,000 shares, and the amount has since been increased to $26,000,000, on which 80 per cent. has been called, making $20,800,000. In April, 1852, $4,000,000 of the 7 per cent. construction bonds were issued at par, and the subscribers to this loan had the privilege of subscribing ten shares of stock for each $1,000 bond. The company purchased their iron, 72,000 tons, in 1852, when it was very low, or less than half the price to which it rose soon after, when the railroad fever developed itself. In October, 1852, the whole line was put under contract, in divisions, and 10,000 men were employed at an expense of $3,700,000 per annum, at work along the line, twelve hours per day, stretching a great highway through fertile plains never before opened, conferring value on them, wealth to the farmers, and strength to the state. As the work progressed, it encountered difficulties from cholera, and the demand for labor which the growing railroad mania caused. The road was opened in 1854, and its earnings for its first year, 1855, were $1,532,118. It sold of its lands 528,863 acres for $5,598,577, and the sales have since reached 1,267,627 acres for $16,230,326, leaving on hand 1,327,372 acres. These lands are quite as valuable for farms as those sold.

The Illinois Central railroad is the longest continuous line of road under the control of a single corporation in the United States. It owns 112 locomotives (of which number twenty-five burn coal), seventy first-class pas-

senger cars, twenty-four baggage and express cars, and 2,295 freight cars. It has extensive workshops for the manufacture and repair of machinery at Chicago, Centralia, and Amboy, with one or two smaller establishments at other places. The road is intersected by and makes connections with sixteen distinct lines of railroad. At its northern terminus—Dunleith—on the Mississippi river, the cars make connections with the boats of the Minnesota Packet Company for the upper Mississippi. The company have recently erected a grain elevator at Dunleith, by which grain will be transferred from the boats to the cars at a considerable saving in labor and expense.

At Cairo, the southern terminus of the road, the cars make direct connections (by steamer to Columbus, Ky.) with the Mobile and Ohio railroad for Memphis, Natchez, Vicksburg, New Orleans, and other southern cities. In Chicago the company's facilities for receiving and forwarding freight are unsurpassed. Sleeping cars are run on all its night passenger trains.

The land department is the most interesting branch of the company. It is divided into three bureaus—the cashier's office, the sales room, and the contract room. The whole force employed in it comprises about twenty-five clerks, one of whom is a brother of Charles Dickens, the distinguished novelist. He is on the sunny side of thirty, is a quiet, unassuming gentleman, and, it is said, writes considerable for some of the leading literary publications in this country. But to return to the lands of the Illinois Central railroad. They comprise an area covering 4,055 square miles, nearly as large as the territory of the state of Connecticut, twice as large as Delaware, more than half as large as Massachusetts, about the same size as the electorate of Hesse-Cassel, three-fourths as large as the grand duchy of Baden, and half as large as the grand duchy of Tuscany.

The most marvellous result of this great work was manifest in the report of the United States land commissioner. The lands through which the road ran had been offered on an average of 15 years at $1.25 per acre, without finding a buyer. All those lands were withdrawn while the company made its selections. When that was done, the lands were again brought into market, in June, 1852, and these in the next twelve months sold in Illinois 298,861 acres for cash, at $2.50 per acre, and 2,509,120 for land warrants. The sales were double the quantity sold in all the states in the previous year. The whole interest of the government in Illinois was speedily closed out. For lands which had been valueless to it before the completion of the road, it realized over $9,000,000. This was the effect of transportation upon those lands.

The first land grants of the government, as we have seen in a preceding chapter, were in aid of canals. The grant to the Illinois railroad was followed by others, and the aggregate grants are as follows to each state :—

	Grants for internal improvements.	Railroad grants.
Ohio	1,243,001.77	....
Indiana	1,609,861.61	....
Illinois	500,000.00	2,595,053
Missouri	500,000.00	1,815,435
Alabama	500,000.00	2,332,918
Mississippi	500,000.00	1,687,530
Louisiana	500,000.00	1,162,580
Michigan	1,250,000.00	3.096,000
Arkansas	500.000.00	1,465,297
Florida	500,000.00	1 814,400
Iowa	1,385,078.22	3,456,000
Wisconsin	1,069,371.99	1,622,800
California	500,000.00	....
Minnesota Ter.	340,000.00	4,416,000
	10,897,313.59	25,464,013

The grants for internal improvements include the canal grants to Ohio, Indiana, and Illinois, as well as for river improvements. The railroad grants, it appears, amount to nearly 25,500,000 acres. These grants have been applied to that purpose by the several states, not always, however, with the best success. The state of Wisconsin was unfortunate in the grants of the state rights, and the land has been withheld in some cases. Minnesota founded a railroad system upon her lands, but up to the present time disaster only has attended it. The system was pushed to its extent in 1857, and then suffered a severe revulsion. With the improved demand for farm produce, migration may be expected to be renewed, and the value of the land grants to be restored.

The land grant of the federal government to Alabama for the Mobile and Ohio road was to the extent of 1,120,000 acres, and it became the basis of a sinking fund for the aid granted to the states of Tennessee, Mississippi, and Alabama. The road is to extend from Mobile bay, in a line nearly due north, to the mouth of the Ohio river, opposite Cairo, a distance of 594 miles. Thence by the Illinois Central it will connect with Dun-

leith, on the upper Mississippi, 928 miles, and also with Chicago and the eastern lines. The road was commenced in 1851, and was pushed through Tennessee to West Point in 1857; it is by the law of that state entitled to a guaranteed state credit of $8,000 per mile, which will carry it to the Kentucky line. The work is one of the most important in the whole country.

The Memphis and Charleston railroad connects Memphis, on the Mississippi, with Charleston, by the way of the Nashville and Chattanooga road. This road connects Charleston and Savannah with the leading cities of the Mississippi river. It is 271 miles long, and forms part of the great through line from Washington to New Orleans. It is well built, and pays 12 per cent. dividends. Its cost was $6,351,752, of which $2,258,115 is capital, and $2,594,000 bonded debt.

The New Orleans, Jackson, and Great Northern road forms the southernmost link of the great chain which stretches 2,000 miles on the Atlantic coast to Bangor, thus connecting codfish with sugar, the Maine law with New Orleans rum. The road runs from New Orleans to Canton, Mississippi, 206 miles. It has, as a matter of course, an immense through business as well as a large local traffic. Its cost has been $8,949,183, of which $4,320,618 is capital, and $3,185,000 bonded debt.

There were completed in January, 1860, the last two links in the great chain of railways from Maine to Louisiana—the first, the last twenty-five miles on the Mississippi Central, and the second, of sixty-one miles between Lynchburg and Charlottesville, on the Orange and Alexandria railroad, popularly known as the Lynchburg Extension. This route, as will be seen by the following table of distances, is within a fraction of 2,000 miles in length, from Bangor to New Orleans, of a continuous rail track, with the exception of four short ferries, viz.: the Hudson river, the Susquehanna, the Potomac, and the James river at Lynchburg, the last two of which will soon be supplied with bridges.

From New Orleans to Canton, Miss., by the New Orleans, Jackson, and Great Northern railway	206
Canton to Grand Junction, Miss., by the Mississippi Central railway	165
Grand Junction to Stephenson, Ala., by the Memphis and Charleston railway	219
Stephenson to Chattanooga, Tenn., by the Nashville and Chattanooga railway	38
Chattanooga to Cleveland, Tenn., by the Cleveland and Chattanooga railway	29
Cleveland to Knoxville, Tenn., by the East Tennessee and Georgia railway	83
Knoxville to Bristol, Tenn., by the East Tennessee and Virginia railway	130
Bristol to Lynchburg, Va., by the Virginia and Tennessee railway	204
Lynchburg to Alexandria, by the Orange and Alexandria railway	169
Alexandria to Washington, D. C., by the Washington and Alexandria railway	6
Washington to Baltimore, Md., by the Baltimore and Ohio railway	39
Baltimore to Philadelphia, by the Philadelphia, Wilmington, and Baltimore railroad	98
Philadelphia to New York, by the Philadelphia and New York railroad line	87
New York to New Haven, Conn., by the New York and New Haven railway	74
New Haven to Springfield	62
Springfield to Worcester, by the Western railway	55
Worcester to Boston, by the Boston and Worcester railway	45
Boston to Portland, Me., by the Eastern and Portland, Saco, and Portsmouth railways	107
Portland to Bangor, Me., by the Penobscot and Kennebec, and Androscoggin and Kennebec railways	137
Total	1,953

This vast chain of railways is composed of nineteen independent roads, costing in the aggregate, for 2,394 miles of road, $92,784,084, or nearly one-tenth of the whole railway system of the United States, of which 1,953 miles are used in this continuous line. The roads from Washington city to New Orleans, embracing a distance of 1,249 miles, have had the contract for the great through mail to New Orleans once a day since July 1, 1858.

The state of Michigan, in 1836, contemplated the construction of three railroads to cross the state: the Southern, from Monroe to New Buffalo; the Central, from Detroit to St. Joseph; and the Northern, from Huron to Grand River. For these roads a state debt of $5,000,000 was contracted; and, in 1838, 28 miles of the Central road had been put in operation, which was extended to 146 miles, at a cost of $2,238,289, and the Southern road, 68 miles, at a cost of $1,125,590, when the state failed and repudiated its debt. As a step toward recovery, a bill was passed, at the suggestion of Mr. Charles Butler, of New York, called the "Butler act," by which the state sold the Central road to a Boston company for $2,000,000 of its own bonds, and the Southern road for $5,000,000 to another company.

Little was done, however, until 1849, when Mr. Butler and others reorganized the Southern company, and the road was pushed to completion. As it approached the Indiana line, an old Indiana state charter was purchased, enabling the company to carry their work through that state to the Illinois line, whence, under the general law of that state, it was pushed on to Chicago. The distance from Monroe, on Lake Michigan, to Chicago, is 246 miles, and the work was completed for $5,000,000, or $20,000 per mile in running order, the level nature of the country being very favorable to the construction of railroads. The work was eminently successful, but became involved through its connection with lateral jobs, which covered it with liabilities greater than its business, large as it was, could carry. It was, like the Erie canal, and indeed many other railroads, overlaid with useless and ill-judged expenditure. The company expended $1,312,534 in aid of other roads, many in nowise connected with it, and in keeping up a ruinous competition. The company thus became hopelessly involved in 1857, when its cost had risen to $19,595,407. Its struggles increased its liabilities, while its business declined. Its main line, Monroe to Chicago, is 246 miles, and six branches raise the length to 509 miles, to which 30 miles leased are to be added.

The Michigan Central reached the lake in May, 1849, and was also pushed to completion, going round the foot of Lake Michigan, where the Illinois Central put out a hand to meet it. The connection is thus 284 miles Detroit to Chicago. The cost of this road was $14,548,411. The road was laid with T rail, and was very prosperous. The capital of the company is $6,057,844, and the debt $8,284,063. The road is an important link in the line of connection between Boston and the western country.

The state of Tennessee has an important system of railroads extending to all sections of the state. The state guarantees $8,000 per mile for the purchase of iron and epuipment, upon the condition that the companies prepare the road bed and defray the charges of construction. The state retains a lien upon the whole property. The roads have been well built.

The state of Missouri had done little toward the construction of roads until the session of 1851, when it agreed to lend its aid to two great lines: the Pacific road, commencing at St. Louis and running across the state, on the south side of the Missouri river, and the Hannibal and St. Joseph road, extending 206 miles across the state from river to river, connecting the two cities named. This last has also a land grant of 600,000 acres, made the basis for $5,000,000 of the company's bonds. The state subsequently enlarged its plan, and agreed to issue some $24,000,000 of its bonds in aid of the railroads. The panic of 1857 supervened before the issue was completed, and many of the roads became embarrassed. The most important of these roads is the Pacific. It has received state aid, direct and contingent, to the extent of $7,500,000, and has also a land grant of 1,127,000 acres. The main line, St. Louis to Kansas city, is 282 miles, running nearly parallel with the Missouri river, and the south-west branch is 283 miles—together, 565. The route open is 63 miles to Syracuse. The cost is $11,701,516, of which $3,319,835 is capital, and bonded debt $8,303,000.

In the following table of the leading railroads of all the states, with the capital paid in and the funded debts outstanding, there are many roads which run through several states. These are given, the whole in those states where their greatest length is. Thus the Boston and Maine road has three miles in Maine, but the whole is put down in Massachusetts. The titles of roads in Italics show the land-grant roads. The figures are from returns a year earlier than those above.

RAILROADS OF THE UNITED STATES—PROJECTED LENGTH AND MILES COMPLETED, WITH THE CAPITAL PAID IN, AND FUNDED DEBT.

Corporate titles of companies.	Total length of Roads.	Length roads completed.	Capital.	Funded Debt.
Androscoggin	36.1	36.1	$151,833	$444,638
Androscoggin and Kennebec	55.6	55.6	457,900	1,748,451
Atlantic and St. Lawrence	149.2	149.2	2,494,900	3,472,000
Branch	1.5	1.5		
Bangor, Oldtown, and Milford	12 3	12.3	135,000	..
Branch	0.5	0.5		
Carried forward	255.2	255.2	3,239,633	5,665,095

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	255.2	255.2	$3,239,633	$5,665,095
Baring and Lewy's Island	17 2	17.2	226,500	..
Calais and Baring	6.0	6.0	224,113	..
Branch	5.5	5.5		
Great Falls and South Berwick	6.0	6.0	175,000	..
Kennebec and Portland	63.0	63.0	1,287,779	1,280,000
Bath branch	9.5	9.5		
Machiasport	7.5	7.5	100,000	..
Penobscot	33.0	..	180,497	300,000
Penobscot and Kennebec	54.7	54.7	555,228	1,206,800
Portland and Oxford Central	28.5	21.5	430,000	..
Portland, Saco, and Portsmouth	51.3	51.3	1,500,000	..
Somerset and Kennebec	39.0	39.0	169,200	556,900
York and Cumberland	55.0	18.5	370,000	450,000
Total Maine	631.4	554.9	8,457,980	9,458,495
Ammonoosuc Valley	20.8	20.8	371,037	...
Ashuelot	23.1	23.1	246,018	150,000
Boston, Concord, and Montreal	93.0	93.0	1,800.000	1,050,000
Cheshire	53.8	53.8	2,085.925	738,200
Cocheco	37.0	28.5	389,047	420,853
Concord	34.5	34.5	1,500,000	..
Contoocook Valley	14.6	14.6	200,000	..
Eastern	16.8	16.8	492,500	42,795
Great Falls and Conway	46.3	20.5	166,748	209,927
Manchester and Lawrence	26.8	26.8	863,400	33,800
Merrimac and Connecticut Rivers	53.8	53.8	595,587	383,400
Northern New Hampshire	69.2	69.2	3,068,400	299,500
Bristol Branch	12.8	12.3		
Peterboro' and Shirley	10.5	10.5	245,643	..
Portsmouth and Concord	46.8	46.8	250,000	..
Sullivan	24.7	24.7	500,000	750,000
Wilton and Nashua	10.3	10.3	232,227	..
Total New Hampshire	594.8	560.5	13,206,532	4,078,475
Connecticut and Passumpsic Rivers	110.3	90.7	1,200,000	800,000
Grand Trunk of Canada	17.3	17.3	345,000	..
Rutland and Burlington	119.6	119.6	2,233,376	3,145,001
Rutland and Washington	44.8	44.8	950,000	..
Rutland and Whitehall	6.8	6.8	255,706	..
Branch	1.5	1.5		
Vermont and Canada	47.0	47.0	1,350,000	..
Vermont Central	118.0	118.0	5,000,000	3,853,000
Branch	4.0	4.0		
Vermont Valley	23.7	23.7	516,164	793,200
Western Vermont	54.0	54.0	332,000	700,000
Branches	10.5	10.5		
Total Vermont	557.5	537.9	12,182,246	9,291,201
New York and Boston air-line	23.3	..	153,312	..
New York, Providence, and Boston	50.0	50 0	1,508,000	306,500
Providence, Warren, and Bristol	13.6	13.6	287,917	109,937
Total Rhode Island	86.9	63.6	1,949,229	416,437
Danbury and Norwalk	23.9	23.9	279,100	85,000
Hartford, Providence, and Fishkill	197.5	122.4	1,936,739	1,810,500
Housatonic	74.0	74.0	2,000,000	232,000
Naugatuck	57.0	57.0	1,031,800	287,300
New Haven and Hartford	55.5	55.5	2,350,000	964,000
Branches	10.6	10.6		
New Haven, New London, and Stonington	61.5	61.5	960,748	866,000
Carried forward	480.0	404.9	8,558,387	4,244,800

Corporate titles of companies.	Total length of roads	Length roads completed.	Capital.	Funded Debt.
Brought forward	480.6	404.9	$8,558,387	$4,244,800
New Haven and Northampton	46.4	46.4	922,500	700,000
Branches	8.8	8.8		
New London, Willimantic, and Palmer	66.0	66.0	510,900	1,052,500
New York and New Haven	62.3	62.3	2,980,839	2,219,000
Norwich and Worcester	59.0	59.0	2,122,500	714,998
Allyn's Point Extension	7.0	7.0		
Total Connecticut	729.5	654.4	15,095,126	8,331,298
Belvidere Delaware	64.2	64.2	977,700	2,049,500
Burlington and Mount Holly	7.1	7.1	120,000	..
Camden and Amboy	63.0	63.0	3,798,400	6,882,000
Branch	31.0	31.0		
Camden and Atlantic	60.0	60.2	657,351	1,006,800
Central of New Jersey	63.0	63.0	2,200,000	3,186,000
Extra track	48.0	48.0		
Flemington	11.8	11.8	238,513	..
Freehold and Jamesburg	17.0	11.0	220,666	..
Millstone and New Brunswick	6.6	6.6	111,114	..
Morris and Essex	92.0	53.0	1,157,800	340,000
Newark and Bloomfield	6.0	6.0	101,387	..
New Jersey	33.8	33.8	3,749,000	188,700
Northern New Jersey	21.7	21.7	154,157	..
Paterson and Hudson	14.5	14.5	630,000	..
Paterson and Ramapo	15.0	15.0	248,225	95,000
Sussex	12.0	12.0	357,078	..
Warren	18.7	18.7	1,024,600	600,000
West Jersey	60.0	13.0	216,794	..
Total New Jersey	645.6	553.6	15,982,785	14,348,000
Agricultural branch	28.4	15.1	312,828	..
Amherst and Belchertown	43.0	19.5	295,337	..
Berkshire	21.2	21.2	600,000	..
Boston and Lowell	26.7	26.7	1,830,000	440,000
Branch	1.8	1.8		
Boston and Maine	74.3	74.3	4,076,974	..
Branches	8.8	8.8		
Boston and New York Central	74.5	74.5	3,692,144	..
Boston and Providence	43.5	43.5	3,160,000	174,200
Branches	12.1	12.1		
Boston and Worcester	44.8	44.8	4,500,000	500,000
Branches	24.3	24.3		
Cape Cod branch	46.1	46.1	681,690	190,000
Branch	1.0	1.0		
Connecticut River	50.0	50.0	1,591,100	252,500
Chicopee branch	2.4	2.4		
Danvers	9.2	9.2	203,150	..
Dorchester and Milton	3.3	3.3	136,789	..
Eastern	44.1	44.1	2,853,400	2,030,500
Branches	30.5	30.5		
Easton branch	3.8	3.8	56,353	..
Essex	19.9	19.9	299,107	280,261
Branch	1.4	1.4		
Fairhaven branch	15.1	15.1	396,085	..
Fitchburg	50.9	50.9	3,540,090	100,000
Branches	16.8	16.0		
Fitchburg and Worcester	14.0	14.0	214,296	62,900
Grand Junction	9.0	9.0	1,895,402	..
Hampshire and Hampden	24.9	24.9	298,951	303,014
Hartford and New Haven	5.9	5.9	369,218	..
Horn Pond branch	0.7	0.7	12,000	..
Lexington and West Cambridge	6.6	6.6	250,357	..
Lowell and Lawrence	12.4	12.4	200,000	100,000
Marlboro' branch	3.9	3.9	156,185	..
Carried forward	775.3	737.7	31,621,456	4,433,375

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	775.3	737.7	$31,621,456	$4,433,375
Medway branch	3.6	3.6	32,554	..
Middleboro' and Taunton	8.1	8.1	149,496	..
Nashua and Lowell	14.4	14.4	600,000	..
New Bedford and Taunton	20.1	20.1	500,000	..
Branch	1.6	1.6		
Newburyport	26.9	26.9	220,240	221,600
New York and Boston air line	32.0	8.6	223,176	675,000
Old Colony and Fall River	79.5	79.5	3,015,100	134,500
Bridgewater branch	7.8	7.8		
Peterboro' and Shirley	14.1	14.1	265,327	..
Pittsfield and North Adams	18.6	18.6	450,000	..
Providence and Worcester	43.4	43.4	1,510,200	300,000
Salem and Lowell	16.9	16.9	243,305	226,900
South Reading branch	8.2	8.2	298,947	..
Branch	0.3	0.3		
South Shore	11.5	11.5	259,685	153,290
Stockbridge and Pittsfield	21.9	21.9	448,700	..
Stony Brook	13.2	13.2	267,364	..
Stoughton branch	4.1	4.7	94,944	..
Taunton branch	11.1	11.1	313,156	..
Branch	0.6	0.6		
Troy and Greenfield	36.5	36.1	385,206	219,000
Vermont and Massachusetts	69.0	69.0	2,214,225	1,003,880
Branch	8.0	8.0		
Waltham and Watertown, horse	2.2	2.2	18,978	..
Western	156.1	156.1	5,150,000	6,125,520
West Stockbridge	2.7	2.7	39,600	..
Worcester and Nashua	45.7	45.7	1,141,000	194,500
Total Massachusetts	1,474.8	1,384.2	49,462,563	13,687,565
Albany and Susquehanna	140.0	..	275,792	..
Albany and West Stockbridge	38.0	38.0	1,000,000	1,289,933
Albany, Vermont, and Canada	31.9	31.9	495,005	1,575,091
Branch	0.8	0.8		
Black River and Utica	108.5	34.9	804,648	700,000
Branch	2.6	2.6		
Blossburg and Corning	14.8	14.8	250,000	220,000
Buffalo, Corning, and New York	142.3	142.0	680,000	2,592,221
Buffalo and New York City	91.0	91.0	755,709	1,720,000
Branch	1.5	1.5		
Buffalo and Pittsburg	75.2	..	133,167	..
Buffalo and State Line	68.3	68.3	1,934,850	1,049,000
Canandaigua and Elmira	69.8	69.8	500,000	..
Canandaigua and Niagara Falls	98.6	98.6	1,300,000	2,195,832
Branch	1.6	1.6		
Cayuga and Susquehanna	34.6	34.6	687,000	411,000
Chemung	17.4	17.4	380,000	70,000
Erie and New York City	63.2	..	352,741	14,000
Genesee Valley	16.0	..	75,689	165,000
Hicksville and Cold Spring	4.1	4.1	52,000	..
Hudson and Boston	17.0	17.0	175,000	..
Hudson River	144.0	144.0	3,758,466	8,842,000
Lake Ontario, Auburn, and New York	73.8	..	71,000	..
Lake Ontario and Hudson River	182.0	..	2,715,186	870,000
Lebanon Springs	22.5	..	324,448	..
Long Island	95.0	95.0	1,852,715	636,997
Hempstead branch	2.5	2.5		
New York and Erie	446.0	446.0	11,000,000	25,326,505
Newburg branch	19.0	19.0		
New York and Harlem	130.8	130.8	5,717,100	5,151,287
Morrisania branch	2.1	2.1		
New York Central	297.7	297.7	24,153,000	14,333,771
Branches, &c	258.2	258.2		
Niagara Falls and Lake Ontario	13.2	13.2	393,721	..
Carried forward	2,724.0	2,057.4	59,837,237	67,112,637

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	2,724.0	2,057.4	$59,837,237	$67,152,637
Northern, Ogdensburg	118.0	118.0	3,077,900	1,500,000
Branch	3.8	3.8		
Oswego and Syracuse	35.9	35.9	396,340	213,500
Plattsburg and Montreal	20.6	20.6	347,775	..
Potsdam and Watertown	75.4	75.4	665,419	911,000
Branch	2.3	2.3		
Rochester and Genesee Valley	49.7	18.5	557,560	150,000
Rensselaer and Saratoga	25.2	25.2	610,000	140,000
Sackett's Harbor and Ellisburg	18.0	18.0	167,485	278,400
Saratoga and Schenectady	21.0	21.0	300,000	85,000
Saratoga and Whitehall	40.9	40.9	500,000	395,000
Rutland branch	6.6	6.6		
Sodus Point and Southern	35.0	..	35,289	..
Staten Island	26.0	26.0	115,000	..
Syracuse, Binghamton, and New York	80.0	80.0	1,200,130	1,643,126
Troy and Bennington	5.4	5.4	75,370	171,200
Troy and Boston	34.7	34.7	604,911	806,500
Troy and Greenbush	6.0	6.0	275,000	..
Troy and Rutland	17.3	17.3	380,818	..
Troy, Union, and Depot	2.0	2.0	7,611	680,000
Union, Ramapo	0.2	0.2	50,000	..
Union, Syracuse	1.3	1.3	77,414	..
Watertown and Rome	96.8	96.8	1,498,500	685,000
Total New York	3,520.4	2,786.3	70,674,768	74,811,371
Delaware and Maryland	84.0	84.0	361,478	931,500
Newcastle and Frenchtown	16.0	16.0	744,520	..
Newcastle and Wilmington	5.0	5.0	93,000	..
Total Delaware	105.0	105.0	1,198,998	931,500
Annapolis and Elkridge	39.0	39.0	462,000	..
Baltimore and Ohio	379.0	379.0	10,011,800	13,881,833
Branches				
Washington line	30.0	..	1,650,000	..
Hoffman's Mines branch	11.0	11.0	500,000	..
Cumberland and Pennsylvania	22.0	22.0	800,000	..
George's Creek Canal and Iron	21.0	21.0	600,000	..
Northern Central	138.0	138.0	2,260,000	5,578,800
Branches				
Western Maryland	14.0	14.0	300,000	..
Sundry coal railroads, say	40.0	40.0	800,000	..
Total Maryland	694.0	694.0	17,383,800	19,460,633
Alexandria, Loudon, and Hampshire	122.0	41.3	1,403,018	36,188
Manassas Gap	105.0	77.8	2,969,861	775,500
Norfolk and Petersburg	79.0	79.0	1,500,124	590,610
North-western Virginia	103.0	103.0	468,605	5,719,229
Orange and Alexandria	149.0	88.0	1,981,167	2,316,879
Fredericksburg and Gordonville	45.0	45.0	231,573	..
Petersburg and Lynchburg	123.0	123.0	1,365,300	1,851,500
Petersburg and Roanoke	59.0	59.0	883,200	102,500
Richmond and Danville	140.0	140.0	1,980,997	907,491
Richmond, Frederick, and Potomac	75.0	75.0	1,041,880	643,960
Richmond and Petersburg	22.0	22.0	835,750	204,808
Richmond and York River	24.0	24.0	657,812	85,000
Seaboard and Roanoke	80.0	80.0	844,200	472,811
Virginia Central	178.0	178.0	3,132,445	1,485,346
Virginia and Tennessee	204.0	204.0	3,353,672	3,247,500
Winchester and Potomac	32.0	32.0	300,000	120,000
Total Virginia	1,540.0	1,371.1	22,949,604	18,559,316
Atlantic and North Carolina	95.0	95.0	1,545,225	400,000
North Carolina	223.0	223.0	4,000,000	..
Carried forward	318.0	318.0	5,545,225	400,000

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	318.0	318.0	$5,545,225	$400,000
Raleigh and Gaston	97.0	97.0	973,300	126,200
Roanoke Valley	22.0	22.0	450,073	..
Western, coal	43.0	..	..	..
Wilmington and Manchester	161.0	161.0	1,127,511	1,060 000
Wilmington and Weldon	162.0	162.0	1,340,217	791,055
Total North Carolina	803.0	760.0	9,436,322	2,377,255
Blue Ridge	183.0	13.0	1,916,515	217,577
Charleston and Savannah	102.0	55.0	706,365	195,266
Charlotte and South Carolina	109.0	109.0	1,201,000	384,000
Cheraw and Darlington	40.0	40.0	400,000	200,000
Greenville and Columbia	143.0	143.0	1,429,008	1,145,000
Branches	21.0	21.0		
King's Mountain	23.0	23.0	200,000	..
Laurens	32.0	32.0	400,000	106.218
North-eastern	102.0	102.0	685,743	960,410
South Carolina	136.0	136.0	4,179,475	2,770,463
Branches	106.0	106.0		
Spartanburg and Union	67.0	25.0	1,000,000	..
Total South Carolina	1,064.0	805.0	12,418,106	5,978,934
Atlanta and West Point	87.0	87.0	1,250,000	250,000
Augusta and Savannah	53.0	53.0	733,700	298,500
Barnesville and Thomaston	16.0	16.0	..	..
Brunswick and Florida	67.0	24.0	151,887	..
Central of Georgia	191.0	191.0	3,750,000	106.267
Georgia and Bank	232 0	232.0	4,150,000	373,000
Macon and Western	102.0	102.0	1,438,800	23,000
Main Trunk (Atlantic and Gulf)	4 0	4.0	63,767	..
Milledgeville and Gordon	17.0	17.0	212,500	..
Milledgeville and Eatonton	22.0	22.0	275,000	..
Muscogee	50.0	50.0	669,950	249,000
Rome and Kingston				
Savannah, Albany, and Gulf	68.0	68.0	1,275,901	10,200
South-western	228.0	228.0	2,921,900	396,500
Western and Atlantic	138.0	138.0	5,901,497	..
Total Georgia	1,275.0	1,222.0	22,794,902	1,582,467
Florida	154.0	62.0	2,500,000	..
Florida and Alabama	45.0	32.0	191,485	195,000
Florida, Atlantic, and Gulf Central	60.0	32.0	205.781	204,600
Pensacola and Georgia	253.0	29.0	800,000	..
Tallahassee	22.0	22.0	425,000	..
Total Florida	534.0	177.0	4,122,266	399,600
Alabama and Florida	135.0	65.0	877,953	503,500
Alabama and Mississippi Rivers	88.0	30.0	355,010	109,500
Alabama and Tennessee Rivers	168.0	109.0	1,067.006	777,777
Marion	14.0	14.0	290,000	..
Mobile and Girard	222.0	57.0	1,500,000	..
Mobile and Ohio	518.0	362.0	3,481,791	4,717,497
Montgomery and West Point	116.0	116.0	1,419,769	922,622
North-east and South-west Alabama	209.0	..	650,000	..
Tennessee and Alabama Central	26.0	..	65,184	..
Total Alabama	1,496.0	753.0	9,646,723	7,030,896
Baton Rouge, Gros Tête, and Opelousas	17.0	17.0	225,000	..
Clinton and Port Hudson	22.0	22.0	750,666	..
Mexican Gulf	27.0	27.0	662,911	..
Milnesburg and Lake Pontchartrain	6.0	6.0	212,398	..
Carried forward	72.0	72.0	1,950,975	..

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded Debt.
Brought forward	72.0	72.0	$1,950,975	$
New Orleans and Carrollton	13.0	13.0	497,220	..
New Orleans, Jackson, and Great Northern	258.0	80.0	1,002,959	2,121,000
New Orleans, Opelousas, and Great Western	411.0	206.0	4,437,990	2,817,000
Vicksburg, Shreveport, and Texas	189.0	21.0	882,922	58,744
Total Louisiana	943.0	392.0	8,672,066	4,996,744
Mississippi Central	236.0	236.0	2,000,961	2,554,732
Mississippi and Tennessee	99.0	71.0	798,285	456,949
Southern Mississippi	143.0	83.0	1,000,000	1,400,000
Grand Gulf and Port Gibson	8.0	8.0	200,000	..
Raymond	7.0	7.0	95,000	..
West Feliciana	26.0	26.0	620,000	..
Total Mississippi	519.0	431.0	4,714,246	4,411,681
Cairo and Fulton	78.0	12.0	50,493	327,000
Hannibal and St. Joseph	206.0	206.0	1,770,612	8,768,000
North Missouri	236.0	168.0	2,620,000	3,250,000
Pacific	311.0	182.0	3,330,657	8,203,000
South-western branch	283.0	19.0	66,974	1,400,000
St. Louis and Iron Mountain	8.6	8.6	1,999,300	3,276,000
Total Missouri	1,200.0	673.0	9,838,036	25,224,000
Breckenridge, coal	8.0	8.0	312,000	..
Covington and Lexington	80.0	80.0	1,582,169	2,930,000
Lexington and Big Sandy	133.0	20.0	694,024	sold for 26,000
Lexington and Danville	35.0	13.0	694,444	71,000
Lexington and Frankfort	29.0	29.0	514,409	130,000
Louisville and Frankfort	65.0	65.0	741,069	456,519
Louisville and Nashville Lebanon branch	269.0	185.0	2,151,430	2,300,000
Maysville and Lexington	90.0	19.0	575,000	..
Paducah and Mobile	26.0	26.0	800,000	..
Portland and Louisville	5.0	5.0	100,000	..
Total Kentucky	740.0	450.0	8,164,545	5,887,519
Central Northern	48.0	48.0	300,000	..
Cleveland and Chattanooga	30.0	30.0	867,210	..
Edgefield and Kentucky	47.0	30.0	333,204	612,000
East Tennessee and Georgia	30.0	30.0	1,289,673	2,020,000
East Tennessee and Virginia	148.0	130.0	536,654	1,902,000
Memphis and Charleston	311.0	300.0	3,809,949	2,659,000
Memphis and Ohio	306.0	300.0	570,000	1,361,000
Memphis, Clarksville, and Louisville	130.0	70.0	298,721	740,000
Mississippi Central, and Tennessee	50.0	60.8	317,447	632,500
Mississippi and Tennessee	100.0	59.0	798,285	554,949
McMinnville and Manchester	41.0	41.0	144,894	406,000
Nashville and Chattanooga	202.0	159.0	2,256,479	1,524,000
Tennessee and Alabama	62.0	46.0	595,922	860,000
Manchester and Alabama	38.0	30.0	216,962	413,000
Total Tennessee	1,543.0	1,346.0	12,335,390	13,684,449
Memphis and Little Rock (Arkansas)	146.0	38.0	351,524	446,000
Sacramento Valley (California)	22.0	22.0	785,950	729,000
Burlington and Missouri	286.0	75.0	752,733	665,000
Chicago, Iowa, and Nebraska	86.0	86.0	516,072	860,000
Dubuque and Pacific	319.0	50.0	838,086	965,000
Iowa Central air-line	438.0	..	245,000	755,000
Keokuk, Fort Desmoines, and Minnesota	140.0	38.0	921,449	570,000
Keokuk, Mount Pleasant, and Muscatine	68.0	11.0	548,216	414,000
Mississippi and Missouri	419.0	107.0	..	..
Total Iowa	1,756.0	367.0	3,821,556	4,229,000

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded Debt.
Ashtabula and New Lisbon	84.8	..	$600,000	..
Bellefontaine and Indiana	118.2	118.2	1,859,813	$1,267,078
Carrollton Branch	11.5	11.5	225,000	..
Central Ohio	137.0	137.0	1,628,356	3,673,000
Cincinnati, Hamilton, and Dayton	60.3	60.3	2,155,800	1,411,000
Cincinnati and Indianapolis Junction	99.1	37.0	1,000,000	..
Cincinnati, Wilmington, and Zanesville	162.8	131.8	2,441,176	3,032,000
Cleveland, Columbus, and Cincinnati	135.4	135.4	4,746,100	38,000
Branches, &c	5.8	5.8		
Cleveland and Mahoning	75.0	67.0	580,000	1,202,300
Cleveland, Painesville, and Ashtabula	95.4	95.4	3,000,000	1,667,000
Cleveland and Pittsburg	101.0	101.0		
Tuscarawas extension	32.0	32.0		
Hanover branch	1.5	1.5	3,942,368	4,918,325
Beaver extension	22.0	22.0		
Wheeling extension	47.0	47.0		
Cleveland and Toledo, N. div	109.2	109.2	3,343,812	3,842,720
" " " S. div	79.4	79.4		
Cleveland, Zanesville, and Cincinnati	114.0	61.4	369,673	575,250
Clinton Line	55.3	..	1,000,000	..
Clinton Line extension	94.6	..	1,983,000	..
Columbus, Piqua, and Indiana	103.0	72.0	750,000	1,600,000
Columbus and Xenia	54.6	54.6	1,490,000	290,700
Dayton and Cincinnati, tunnel	53.2	..	2,000,000	..
Dayton and Michigan	144.0	144.0	2,108,380	2,513,400
Dayton and Western	36.6	36.6	289,692	700,000
Dayton, Xenia, and Belpre	63.0	16.0	437,838	422,658
Eaton and Hamilton	45.0	45.0	469,762	728,853
Four Mile Valley	34.0	..	300,000	..
Fremont and Indiana	120.0	36.0	1,000,000	..
Greenville and Miami	32.0	32.0	300.000	473,000
Iron	47.0	13.0	118,865	50,000
Little Miami	83.4	83.4	2,981,293	1,399,000
Marietta and Cincinnati	173.8	173.8	1,399,000	7,405,917
Hillsboro' branch	21.6	21.6		
Ohio and Mississippi	192.3	192.3	6,584,681	9,880,000
Pittsburg, Columbus, and Cincinnati	117.0	117.0	1,906,736	2,400,000
Cadiz branch	8.0	8.0		
Pittsburg, Maysville, and Cincinnati	225.0	..	390,933	..
Sandusky, Dayton, and Cincinnati	153.9	153.9		
Old line	52.0	52.0	2,697,090	2,134,000
Findlay Branch	16.0	16.0		
Sandusky, Mansfield, and Newark	116.0	116.0	828,583	1,402,572
Huron branch	9.0	9.0		
Scioto and Hocking Valleys	130.0	55.5	403,975	500,000
Springfield and Columbus	43.0	19.5	193,000	150,000
Springfield, Mount Vernon, and Pittsburg	112.0	49.0	1,000,000	1,050,000
Tiffin and Fort Wayne	102.7	..	150,000	..
Toledo, Wabash, and Western	243.0	243.0	3,573,000	7,650,000
Total Ohio	4,282.0	3,060.0	62,326,631	61,376,763
Detroit and Milwaukee	188.0	188.0	2,950.009	4,250,000
Detroit, Monroe, and Toledo	51.0	51.0	1,202,821	..
Grand Rapids and Indiana	183.0	..	..	..
Iron Mountain, N. Michigan	25.0	25.0	600,000	..
Michigan Southern and Northern Indiana	246.0	246.0		
Constantine branch	4.0	4.0		
Old Goshen branch	10.0	10.0		
Michigan City branch	14.0	14 0		
St. Joseph Valley railroad	8.0	8.0	8,975,400	9,343,000
Jackson branch	42.0	42.0		
Goshen air-line	120.0	120.0		
Toledo section	3.0	3.0		
Ohio section of D. M. and T. Railroad	7.0	7.0		
Erie and Kalamazoo	30.0	30.0		
Carried forward	931.0	748.0	13,728,230	13,593,000

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Brought forward	931.0	748.0	$13,728,230	$13,593,000
Michigan Central	284.0	284.0	6,057,844	8,284,063
Port Huron and Milwaukee	89.8	..	500,000	..
Flint and Pere Marquette	173.0	..	..	..
Total Michigan	1,477.8	1,032.0	20,286,061	21,877,063
Chicago and Cincinnati	104.0	..	..	..
Cincinnati and Chicago	108.0	108.0	1,196,679	1,006,125
Cincinnati, Peru, and Chicago	102.0	29.0	1,000,000	..
Evansville and Crawfordsville	109.0	109.0	986,061	1,219,100
Evansville, Indianapolis, and Cleveland	155.0	..	835,000	..
Indiana Central	72 4	72.4	611,050	1,166,000
Indiana and Illinois Central	70.0	..	..	..
Indianapolis and Cincinnati	89.8	89.8	1,689,900	1,362,284
Cincinnati extension	20.2	20.2		
Indianapolis, Pittsburg, and Cleveland	84.0	84.0	835,971	1,025,700
Jeffersonville	78.0	78.0	1,014,252	681,000
Knightstown and Shelbyville	27.0	27.0	188,000	..
Lafayette and Indianapolis	64.0	64.0	1,000,000	600,000
Madison and Indianapolis	86.0	86.0	1,647,700	1,336,816
Martinsville branch	26.0	26.0		
Shelbyville branch	23.0	23.0		
New Albany and Salem	288.0	288.0	2,800,000	3,000,000
Peru and Indianapolis	74.0	74.0	1,100,000	820,000
Rushville and Shelbyville	20.0	20.0	120,000	..
Shelbyville Lateral	16.0	16.0	160,000	..
Terre Haute and Richmond	73.0	73.0	1,381,450	230,000
Union Track, Indianapolis	3.5	3.5	265,033	..
Total Indiana	1,692.9	1,290.9	16,831,096	12,447,025
Chicago, Alton, and St. Louis	220.0	220.0	3,500,000	4,500,000
Chicago, Burlington, and Quincy	138.0	138.0	4,631,540	3,158,000
Chicago and Milwaukee	45.0	45.0	988,000	762,865
Chicago and Rock Island	181.8	181.8	5,603,000	1,397,000
Chicago, St. Paul, and Fond du Lac	196.0	196.0	2,000,000	7,369,000
Fox River Valley	33.2	33.2	1,000,000	580,000
Galena and Chicago Union	121.0	121.0	6,026,400	3,783,015
Fulton and Iowa line	105.5	105.5		
Beloit branch	21.0	21.0		
Elgin branch	1.5	1.5		
St. Charles branch	10.5	10.5		
Great Western	178.0	175.6	1,600,000	3,088,426
Illinois Central	308.0	308.0	10,249,210	20,000,000
Chicago branch	250.0	250.0		
Galena branch	146.0	146.0		
Illinois Coal	4.0	4.0	100,000	..
Illinois and Indiana Central	74.5	..	..	..
Illinois River	81.5	..	..	..
Joliet and Chicago	35.0	35.0	750,000	..
Joliet and Northern Indiana	45.0	45.0	1,300,000	..
Mound City	3.0	3.0	60,000	..
Ohio and Mississippi	148.0	148.0	1,780,295	3,292,402
Peoria and Bureau Valley	46.0	46.0	..	600,000
Peoria and Hannibal	129.0	..	200,000	..
Peoria and Oquawka	94.0	94.0	1,560,889	2,200,000
Eastern extension	92.0	92.0		
Quincy and Chicago	100.0	100.0	800,000	1,200,000
Quincy and Eastern	43.0	43.0	..	..
Rock Island Bridge	1.0	1.0	200,000	..
Terre Haute, Alton, and St. Louis	168.5	168.5	3,026,903	5,035,615
St. Louis branch	25.0	25.0		
Belleville division	14.8	14.8		
Tonica and Petersburg	120.0	..	500,000	..
Total Illinois	3,177.4	2,772.4	45,885,237	56,966,324

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded debt.
Alleghany Valley	181.0	45.0	$ 1,660,000	$400,000
Beaver Meadow	20.0	20.0	1,410,900	2,000
Catawissa, Williamsport, and Erie	63.0	63.0	1,700,000	2,271,536
Cumberland Valley	52.0	52.0	981,900	245,500
Delaware, Lackawanna, and Western	193.0	193.0	3,360,872	6,070,125
East Pennsylvania	36.0	36.0	386,121	365,500
Erie and North-east	22.0	22.0	600,000	400,000
Harrisburg and Lancaster	55.0	55.0	1,087,100	661,000
Hempfield	32.0	32.0	1,809,563	..
Huntingdon and Broad Top	46.0	42.0	425,015	1,000,000
Lackawanna and Bloomsburg	69.0	69.0	710,000	1,000,000
Lehigh Valley	45.0	45.0	1,966,350	1,500,000
Little Schuylkill	46.0	28.0	2,256,100	942,500
Lehigh Coal and Navigation	24.0	20.0	2,479,900	3,619,304
Mine Hill and Schuylkill Haven	145.0	72.0	2,800,000	..
North Pennsylvania	75.0	66 0	3,155,820	2,787,000
Pennsylvania	386.0	386.0	13,249,125	16,932,517
Philadelphia and Baltimore Central	79.0	12.0	..	250,000
Philadelphia, Germantown, and Norristown	24.0	24.0	1,208,500	374,800
Philadelphia and Reading	151.0	151.0	11,737,041	12,195,950
Philadelphia and Trenton	28.0	28.0	1,000,000	..
Philadelphia, Wilmington, and Baltimore	104.0	98.0	5,600,000	2,498,435
Pittsburg and Connellsville	147.0	60.0	1,753,864	1,500,000
Pittsburg, Fort Wayne, and Chicago	467.0	467.0	6,266,278	8,895,457
Pittsburg and Steubenville	31.0	31.0	1,221,277	280,000
Schuylkill and Susquehanna	54.0	54.0	1,258,700	97,000
Schuylkill Valley	39.0	24.0	568,150	..
Shamokin Valley and Pottsville	33.0	28.0	500,000	821,447
Sunbury and Erie	148.0	148.0	4,506,920	4,369,070
Tioga	29.0	29 0	97,550	396,000
Westchester and Philadelphia	26.0	26.0	682,170	944,169
Williamsport and Elmira	78.0	78.0	1,500,000	2,361,973
Total Pennsylvania	2,928.0	2,044.0	57,939,216	73,181,283
Kenosha and Rockford	176.0	55.0	800,000	700,000
Lacrosse and Milwaukee	199.0	199.0	10,872,000	10,414,066
Milwaukee and Chicago	40.0	40.0	1,000,000	600,000
Milwaukee and Horicon	42.0	42.0	1,101,200	..
Milwaukee and Mississippi	260.0	234.0	3,696,693	4,047,000
Milwaukee, Watertown, and Baraboo	130.0	130.0	345,861	132,000
Racine and Mississippi	142.0	136.0	2,705,720	1,417,000
Wisconsin Central	65.0	10.0	600,000	..
Total Wisconsin	1,054.0	846.0	21,121,474	17,310,066
Buffalo Bayou	190.0	32.0	..	..
Galveston, Houston, and Henderson	240.0	56.0	..	..
Houston and Brazoria	125.0	50.0	275,000	240,000
Houston and Texas Central	125.0	70.0	455,000	975,000
San Antonio and Mexican Gulf	135.0	25.0	..	..
Southern Pacific	784.0	28.0	..	..
Total Texas	1,824.0	251.0	730,000	1,215,000
Minnesota and Pacific	620.0	..	..	600,000
Southern Minnesota	175.0	..	..	575,000
Minneapolis and Cedar Rapids	112.0	..	..	600,000
Minnesota Transit	200.0	..	..	500,000
Root River Valley	60.0	..	..	..
Total Minnesota	1,167.0	..	..	2,750,000

There is, in addition to the roads here mentioned, a considerable length, probably 2,000 miles in all, employed in mining districts, and not used for general traffic. The grand result is over 28,000 miles of road, which have cost, in capital and funded debt, $1,066,866,284, which has been expended in the period since the first road was begun.

RECAPITULATION BY STATES.

Corporate titles of companies.	Total length of roads.	Length roads completed.	Capital.	Funded Debt.
Maine	631.4	554.9	$8,457,980	$9,458,495
New Hampshire	594.8	560.5	13,006,532	4,078,475
Vermont	557.5	537.9	12,182,246	9,291,201
Rhode Island	86.9	63.6	1,949,229	416,437
Connecticut	729.5	654.4	15,095,126	8,331,298
Massachusetts	1,474.8	1,384.2	49,462,563	13,687,565
New York	3,520.4	2,786.3	70,674,768	74,811,371
New Jersey	645.6	553.6	15,982,785	14,348,000
Pennsylvania	2,928.0	2,044.0	57,939,216	73,181,283
Delaware	105 0	105.0	1,198,998	931,500
Maryland	694.0	694.0	17,383,800	19,460,633
Virginia	1,540.0	1,371.0	22,249,604	18,559,316
North Carolina	803.0	760.0	9,436,322	2,377,255
South Carolina	1,064.0	805.0	12,418,106	5,978,934
Georgia	1,275.0	1,222.0	22,794,902	1,582,467
Florida	534.0	177.0	4,122,262	399,600
Alabama	1,496.0	753.0	9,646,723	7,030,896
Louisiana	943.0	392.0	8,672,066	4,996,744
Mississippi	519.0	431.0	4,714,246	4,411,681
Missouri	1,200.0	673.0	9,838,036	25,224,000
Kentucky	740.0	450.0	8,164,545	5,887,519
Tennessee	1,543.0	1,356.0	12,335.400	13,684,449
Arkansas	146.0	38.0	351,524	446,000
California	22.0	22.0	785,950	729,000
Iowa	1,756.0	367.0	3,821,556	4,229,000
Wisconsin	1,054.0	846.0	21,121,474	17,310,066
Minnesota	1,167.0	..	..	2,275,000
Texas	1,824.0	251.0	730,000	1,215,000
Illinois	3,177.4	2,772.4	45,885,237	56,966,324
Indiana	1,692.9	1,290.9	16,831,096	12,447,025
Michigan	1,477.8	1,032.0	20,286,061	21,877,063
Ohio	4,282.2	3,060.1	62,326,631	61,376,763
Total	40,224.1	28,007.8	$569,865,924	$497,000,360

The expenditure of such an enormous sum of money, amounting to $54 per head for the average population during the 30 years in which they have been building, is marvellous in so young a country, which, 40 years before this outlay occurred, was mostly destitute of capital. The railroads, however, exist, and capital is now, at this moment, more abundant for general purposes than it was before the construction of the railroads. It is, in fact, cheaper in the general market, and in this we recognize the vast utility of the works in developing capital. The operation has been to bring the production of millions of acres into general circulation, more than supplying the absorption that the railroad building occasioned. It is to be considered that a considerable amount, probably $300,000,000, has been borrowed in Europe. For the, in round numbers, 26,000 miles of road built since 1840, there would have been required very nearly 2,600,000 tons of railroad iron, which, at an average price, was worth $104,000,000. There was imported in the same time, 1840 to 1849 inclusive, 1,714,343 tons, at a cost of $69,799,797, mostly purchased in exchange for bonds. In the six years ending with 1857 there were opened 14,335 miles of railroad, which required 1,304,485 tons. In the same period there were imported 1,289,787 tons. Thus the quantity of domestic required was 14,698 tons in addition to the renewal of old rail. A good deal of iron was bought at very high prices proportioned to the estimated values of the bonds. That some of those bonds have not been paid is true, and also that iron was very bad. The iron has been, therefore, a positive advance to the capital of the country, to be paid out of the products of the earth newly opened to market by its means. In illustration of the value conferred by the means of transportation, we may take the Philadelphia coal fields; these were discovered as fuel in 1820. The quantity that has since been delivered is seen in the following table:—

	Tons.
1820 to 1840.....21 years	6,847,179
1840 to 1850.....10 "	22,034,961
1850 to 1860..... 9 "	55,742,000
Total tons coal	84,624,140

This, at an average value of $5, gives $423-120,760. If this coal is assumed to have been transported 100 miles average at the cost of transportation on common roads, the expense would have swallowed up the whole value, but there have been built, running into the anthracite region, the following works:—

	Miles.	Cost.
11 canals	815	$40,556,775
40 railroads	1,564	86,773,269
Total		$127,330,044

Under the supposition that the coal transported pays the interest on this cost, which would be $8,690,000 per annum, then the 7,626,000 tons brought to market last year, at a value of $38,000,000, paid $1.12 per ton, or 22 per cent., thus bestowing a clear value of $29,000,000 per annum upon those fields. The Cumberland coal fields also deliver over the Baltimore and Ohio road 617,010 tons per annum. The annual sale of coal from those regions of Pennsylvania is, including the quantities used locally, $40,000,000. This sum is added to the floating capital of the country as a consequence of the $127,330,044 absorbed in constructing the roads. In other words, the cost of construction is repaid in three years nearly, and a perpetually increasing fund flows down for the promotion of trade, since coal is as much a purchasing power for goods as is gold. What those roads have done for coal have the southern roads done for cotton. Formerly the water-courses were the only means of transportation; and when they were dry or shallow cotton accumulated at the landings until the next flood. The iron arms now stretch out in all directions, and not only is all the cotton grown added to the marketable value, but new lands are brought into action. The effect of railroads upon cotton is seen in the following table, which shows the miles of railroad open in 10 cotton states, and the quantity of cotton produced:—

	Miles of road.	Cotton crop. Bales.		Miles of road.	Cotton crop. Bales.
1841	662	1,634,945	1851	1,560	2,355,257
1842	791	1,683,574	1852	2,010	3,015,029
1843	848	2,378,875	1853	2,515	3,262,882
1844	932	2,030,401	1854	3,040	2,930,027
1845	1,109	2,394,503	1855	3,362	2,847,339
1846	1,169	2,100,537	1856	3,809	3,527,845
1847	1,303	1,778,651	1857	4,165	2,939,519
1848	1,319	2,347,634	1858	4,751	3,113,962
1849	1,415	2,728,596	1859	5,552	3,851,481
1850	1,415	2,096,706	1860	5,914	4,675,770
Total		21,174,422			32,519,111

The value of the 5,914 miles of roads built is not far from $150,000,000, but the value of the cotton produced and brought to market has been in the 20 years $2,900,-000,000. The increase in the value during the last 10 years over the former decade has been $800,000,000. That vast sum has poured out upon the markets of the world as a purchasing power, stimulating industry at home and abroad to produce the equivalents to give in exchange, and which have been consumed by the southern cotton producers.

In the western country the results are still more marked, since a country which was a wilderness has, under the influence of railroads opening the way, become the source of immense wealth. This influence upon the grain business of Chicago is seen in the following table, which shows the number of miles in operation in Illinois and Wisconsin, in each year, and the bushels of grain received in Chicago for corresponding years:—

	Miles of railroad. Illinois.	Wisconsin.	Grain receipts. Bushels.
1841	22	..	40,000
1852	148	20	5,873,141
1853	296	50	6,412,181
1854	1,200	200	12,932,320
1855	1,884	240	16,633,700
1856	2,241	285	21,583,221
1857	2,571	559	18,032,678
1858	2,678	793	20,035,166
1859	2,774	838	21,736,147
1860	2,811	951	40,000,000

The cost of the Illinois and Wisconsin railroads has been $141,283,691, most of it furnished by the eastern states and by Europe. In the same period there have been sold by the federal government, in Illinois, 15,000,000 acres of land, and the canals and railroads have sold 3,000,000 acres. This land now sends forth, it appears, over these

railroads, 40,000,000 bushels of grain, at a value of $60,064,575 per annum, as estimated by Col. Graham, of the United States Engineers, and Chicago sends back, in return, a value of $60,608,779. Two years and a half of such production gives the whole cost of the railroads, and a permanently increasing affluence of wealth from that region. The railroads of the other sections bordering the Lakes have not been less efficient.

As an illustration take Chicago as a great railroad centre:—

	Passengers.	Freight.	Mail and Mis.	Total.
Chicago and Milwaukee	$145,580 84	$46,363 40	$12,235 91	$204,186 15
Racine and Mississippi	41,151 80	114,077 85	..	155,229 65
Lacrosse and Milwaukee	205,745 19	269,941 10	16,767 45	492,453 74
Chicago and St. Paul	102,876 26	194,608 50	12,824 92	310,319 68
Milwaukee and Mississippi	305,305 93	557,900 20	17,479 89	383,176 01
Galena and Chicago	1,022,141 65	472,269 13	53,150 45	1,547,561 33
Mineral Point	14,015 77	37,487 05	1,552 52	53,055 35
Chicago and Iowa	15,379 29	32,817 86	2,555 08	50,853 24
Chicago and Burlington	533,034 75	103,421 97	34,252 92	1,600,709 63
Dubuque	30,900 17	29,468 83	1,200 00	61,578 00
Burlington and Missouri	46,377 58	42,869 46	1,975 06	91,222 10
Chicago and Rock Island	449,526 02	439,152 32	43,101 66	981,789 00
Mississippi and Missouri	90,280 02	124,162 51	3,400 00	717,842 53
Chicago, Alton and St. Louis	417,800 26	424,734 84	24,753 32	967,288 52
Illinois Central	819,829 87	975,904 87	180,804 28	1,976,578 52
Pitts., Ft. Wayne, and Chicago	742,372 04	699,053 79	126,354 35	1,567,780 18
Michigan Southern	920,366 53	849,528 36	269,452 08	2,039,346 97
Michigan Central	1,013,062 24	931,753 98	71,370 63	2,016,186 85
Total				$15,297,156 85

This gives a value of $15,297,155 earned by roads running into Chicago from almost every point of the compass. A large portion of the earnings were derived from passengers who had been connected with railroad building and land speculation.

While all these rivers, canals, and roads have been busy bringing down produce from swelling numbers of settlers, the traffic of the great outlets has been equally as active. We are to bear in mind that in 1825, when the Erie canal opened, there was no transportation of produce from west to east of the mountains. Bearing that in mind, we shall inspect the following table with interest. It shows the tonnage and revenues of the five great outlets, for the year 1859, as follows:—

THROUGH TONNAGE.

Going	East.	West.	Total tonnage.
New York canals	2,121,672	317,459	3,781,684
New York Central	234,241	113,833	834,379
New York and Erie	200,000	60,000	869,072
Pennsylvania railroad	129,767	103,839	1,170,240
Baltimore and Ohio railroad	135,127	66,470	897,496
Total	3,820,807	667,601	7,552,871

RECEIPTS.

	Freight.	Passengers.	Total receipts.
New York canals(tolls)	$1,723,945	..	..
New York Central	3,357,148	$2,566,369	$6,200,848
New York and Erie	3,108,248	1,154,088	4,394,527
Pennsylvania railroad	3,419,494	1,412,603	5,362,355
Baltimore and Ohio	2,928,411	690,207	3,613,618
Total	$14,517,246	$5,823,262	$19,571,348

Thus these five routes collected in 1859 $14,517,246 in tolls and freights, and $5,823,262 from passenger traffic. This has been the sum of the progress in transportation across the mountains east and west. The vast lines of railroads now in operation are probably more than the present wants of all parts of the country may require, but the glance we have made at the past shows that the country will very soon outgrow this supply of rails, and call for a completion of those projected.

This immense length of continued rail now enables an individual to travel from one extremity of the Union to the other without fatigue; not only are the distances shortened, but every appliance for comfort makes the journey, even to invalids, commodious. For this purpose there have been recently introduced on the long lines, sleeping-cars, wherein the passenger takes his natural rest while the iron horse is whirling him toward his destination at the rate of 30 miles an hour. This is an improvement upon the invention introduced by Captain Bunker, as we have seen on the Hudson river sloops in the early part of the century, whereby gentlemen and ladies could be accommodated with beds. They were probably more necessary in that day, however, when it might have been necessary to while away the time in their berths. The rail cars do not go the less rapidly that the passengers are well accommodated. There have been

many instances not only of berths provided but of births taking place in the cars. Such an event happened on the Long Island cars, which were going at the speed of 40 miles per hour, and a grave difficulty sprang up as to where the young gentleman was born, a problem not easily solved, when towns passed at the rate of a mile in 90 seconds.

We have seen that the passenger of the present day does not occupy much time in performing long distances, and that these passages are by no means costly as compared with the inconvenient mode of locomotion in the olden time. Twenty years since it was recorded as a marvel that a gentleman made the distance from Chicago to Albany in 154 hours, or 6 days and 10 hours, and 24 days from New Orleans to Baltimore was recorded as matter of wonder. Now, 89 hours from New York to New Orleans is an easy passage, and Cincinnati is reached in 36 hours. A passenger is booked through from Bangor to New Orleans in less time than was employed to go from Boston to New York. From New York, as the great centre, lines radiate in all directions, bringing the most distant cities within a more convenient distance than was Philadelphia in the past century.

It is instructive to look back at the changes the means of locomotion have wrought in the views of passengers. At the close of the last century enterprising contractors advertised as follows:—

"PHILADELPHIA STAGE-WAGGON and NEW YORK STAGE-BOAT, *performs* their *Stages* twice a *Week*. John Butler, with his waggon, sets out on Mondays from his House, at the Sign of the Death of the Fox, in Strawberry-ally, and drives the same day to Trenton Ferry, when Francis Holman meets him, and proceeds on Tuesday to Brunswick, and the passengers and goods being shifted into the waggon of Isaac Fitzrandolph's the same day, where Ruben Fitzrandolph, with a boat well suited, will receive them, and take them to New York that night. John Butler returning to Philadelphia on Tuesday with the passengers and goods delivered to him by Francis Holman, will again set out for Trenton Ferry on Thursday, and Francis Holman, &c., will carry his passengers and goods, with the same expedition as above to New York."

By this remarkably ingenious plan and diction of John Butler, everybody got to his journey's end in the course of time; "with the same expedition as above," that is, it appears, from Monday morning to Tuesday night, if Ruben Fitzrandolph's boat did not get aground or becalmed, or weather-bound, or driven off, in either of which cases the time of arrival was dubious. But honest John "with his waggon," was soon "cut out." Those "Yankees," immortalized by Knickerbocker, came down from the north and innovated even upon so admirable an arrangement as was here devised in the tap-room of the "Death of the Fox," Strawberry-ally, under the administration of Jefferson. Ruben's boat with its vicissitudes was abandoned, notwithstanding the attractions of the "Kill van Kull" passage, and a land route through adopted. The attractions of this route were set forth as follows:—

"FOR PHILADELPHIA AND BALTIMORE—SWIFTSURE MAIL STAGE.—A new line has removed from No 2 Courtlandt street to No. 116 Broadway, and is now running between New York and Philadelphia, through a beautiful country, and on the short and pleasant road through Newark, Springfield, Scotch Plains, Bound Brook, Somerset, Arnwell, Coryell's Ferry, Cross Road, Crooket Billet, and Jenkintown to Philadelphia.

"To start from New York every day at 10 o'clock, A. M. (Sundays excepted,) lodge at Somerset, and arrive at Philadelphia next day afternoon. The Swiftsure is the only opposition stage from this city to Philadelphia and Baltimore."

There does not appear to have been much time saved by this new plan, any further than that the vicissitudes of the boats were exchanged for those of muddy roads. Spring coaches had, however, supplanted honest John Butler's wagon, since travellers had become more dainty. A few years more brought steam into competition for the use of travellers, and the number multiplied to such an extent, that, on the occasion of the great semi-centennial jubilee anniversary of the National Independence, held July 4, 1825, it was recorded in *The Philadelphia Gazette*, that 300 New Yorkers were said to have been in Philadelphia. There were passengers enough to fill 35 *coaches!* Great doings, that, in the travelling way! What would Francis Holman have done with the crowd between Brunswick and Trenton? Travelling had clearly outgrown his arrangements. Well, 35 years more passed on, and railroad connections being constructed, the

papers of the day contained a new advertisement of a trip to Philadelphia. It was no longer "John Butler with his waggon," but that "John Brougham with his company" would perform as usual in the evening at the New York theatre, then proceed by the cars to Philadelphia and perform at the theatre there in the same evening, and return to New York to sleep. Thus two performances were had in two cities 90 miles distant, and the passage made both ways in the same evening by rail! The ordinary passage is some 4 hours, and the expense $3.00. The fare is reduced to $2.25, if the passenger does not care about an hour or so of time.

The influence of these great improvements in travel has been in an eminent degree to consolidate population in cities, and these grow the more readily that the distance within which perishable food can be brought to market is so much increased by rapidity of travel. The elements of growth of a city are supplies of food; fuel, and water. Unless these are abundant and cheap, the disadvantages thence arising will counterbalance the geographical and commercial advantages of a city. To supply food the circle of country about the city which supplies market-gardens, dairies, etc., must be fertile and accessible. The width of this ring, or, in other words, the area thus devoted, is determined by the speed with which the produce can be transported. The distance of its extreme limits must not be greater than will permit the products to reach the centre in time for use; any improvement that enables a larger space to be gone over in the same time increases the area of dwellings and market-lands. The area thus commanded increases as the square of the distances. Thus, if the speed is doubled, the area is four times as large, if it is tripled, the area adapted to city supplies is *nine* times as great, consequently there will be nine times as much milk, butter, vegetables, food, and produce as before. Steamboats opened a market in New York for large quantities of early southern fruits and vegetables that compete with those coming by rail from a country before secluded. If the city is thus benefited, so are the distant farms, the value of which, as compared with those near, becomes equalized. If wheat is worth $1.00 in the city, and it cost 25 cents to get it there from a certain farming district, the producer will get 75 cents only. If the cost of transportation be reduced to 10 cents, then there is 15 cents to be divided between the city consumer and the producer. The comparative influence of a railroad in effecting this result over a common road is great.

Another very important development of railroads has been for city service. It is now nearly 30 years since, the city of New York having spread over a greater surface of ground than it was convenient to walk over, lines of omnibuses were started to run on the great thoroughfares, to carry passengers. The price was, at first, 12½ cents for a ride any distance on the line. This was gradually reduced to 6 cents. About the year 1852, however, the plan of horse railroads was proposed, and one was laid down the Sixth Avenue, to the lower part of the city. This was at once eminently successful. The advantages accruing to the general benefit from the development of this system may be briefly enumerated as follows:—The quickest, cheapest, and most agreeable facilities of travel to all parts of the city; the surprising increase of the value of property upon the outskirts, now easy of access at all hours of the day and evening; the spreading of the laboring population to the suburbs, and the consequent rapid extension of the city; the opening of new branches of occupation by the necessity created for conductors and drivers, and the building of cars; and, lastly, the creation of an extensive and profitable investment for capital, the stock of some of these lines of railway being eagerly sought as safe and lucrative. It resulted, that others were put into operation. The plan was soon adopted in Boston, and in Philadelphia, which is, from its broad and rectangular streets, well adapted to railroad travel. From there the system has spread to Baltimore, Pittsburg, Cincinnati, St. Louis, New Orleans, and other cities. The extent of the roads is as follows:—

	No.	Miles.	Cost.
Boston	5	30.4	$968,943
New York and Brooklyn	7	56.8	5,212,586
Philadelphia	18	154 8	8,550,000
Total	30	242.0	14,731,529

The amount of traffic on these roads is immense. In New York, the number of passengers carried in a year more than equals the whole population of the United States. Thus while the railroads favor the settlement of cities, by concentrating in them a large manufacturing and commercial population, which can draw cheap food from

every section of the Union, they at the same time circulate that city population cheaply and speedily, enabling them to occupy a larger space of ground, and at the same time concentrate the manufacturing operations in a manner to facilitate the greatest production of commodities that are reciprocally required by the producers of food. In no country have railroads been availed of to the extent which the United States exhibit. Under the free action of the national energy, the roads have multiplied in a marvellous manner, but it is to be remembered that this has had an immense tract of rare and fertile soil to respond to the operations of the roads, and the country has been taken up, step by step, by an immense immigration. Such a state of affairs cannot exist in Europe. There are no new lands and crowds of immigrants, the resources of which need only the railroad to be developed. There the money put into railroads is a positive investment, here it calls into activity a sum larger than its own amount. The gross income of 257 roads in the United States, for 1859, was $111,203,245 freights and passengers, or $4 per head for each soul in the Union. This was for goods transported and for travelling. The roads of the United States, as compared with Europe and Great Britain, will be seen in the following tables of the number of miles in operation throughout the globe at the commencement of the year 1857:—

United States	28,500 miles.
Canada and British Provinces	1,465 "
Cuba	391 "
Jamaica	10 "
New Granada	49 "
Brazil	53 "
Peru	22 "
Chili	80 "
England and Wales	6,426 "
Scotland	1,138 "
Ireland	1,012 "
Spain	263 "
France	3,712 "
Belgium	1,119 "
Holland	422 "
Denmark	188 "
Norway and Sweden	67 "
Russia and Poland	637 "
Prussia	2,309 "
Smaller German States	4,235 "
Austria and Hungary	1,697 "
Switzerland	167 "
Italy	812 "
Egypt	132 "
British India	311 "
Australia	39 "
Total of railways in the world in 1857	55,256 "

The comparative cost of the roads by another authority is as follows:—

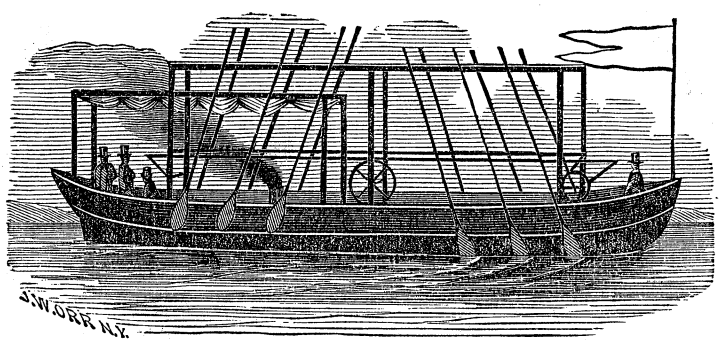
	Miles.	Cost.	Cost per mile.
United States	28,037	$1,086,865,399	$38,800
Great Britain	8,297	1,487,916,420	179,000
France	4,038	616,118,995	152,000
Germany	3,213	228,000,000	71,000
Prussia	1,290	145,000,000	63,000
Belgium	1,095	98,500,000	90,000
British Provinces	826	41,600,000	50,000
Cuba	359	16,100,000	41,000
Panama	47	7,000,000	150,000
South America	60	4,500,000	75,000
Russia	422	42,000,000	100,000
Sweden	75	7,500,000	100,000
Italy	170	17,000,000	100,000
Spain	60	6,000,000	100,000
Africa	25	3,100,000	125,000
India	100	15,000,000	150,000
Total	48,114	$3,823,200,814	$79,000

Although the territories of the United States abutting on the Pacific coast and the north-west were the scene of Mr. Astor's enterprise early in the century, California, up to the Mexican war in 1846, was an unknown region. That war resulted in an acquisition of territory, that was no sooner annexed, than the inquisitive settlers discovered those gold treasures that set the world in a blaze, and made that region the centre of migration for many years. The route thither was by Cape Horn, on a voyage of many months, or across Central America, by a perilous journey. That was not to be suffered long by a people who had learned the art of railroad building, and the Panama railroad, 48 miles, was constructed at a cost of $8,000,000; $4,973,000 capital, and $2,427,000 debt. This road, connecting on the Atlantic side with New York by a steam-line, and on the Pacific side with San Francisco, by another, became at once the great route, and its revenue last year was $1,925,444. The facilities of trade thus afforded, caused a rapid multiplication of people on the north-west coast, the more so that new discoveries of gold were being made. Meantime the public mind was awakened to the necessity of an inland route by rail, not only to shorten the transport trade from India, but as a means of support, in case of war, and also as a bond of union. The undertaking was regarded with hesitation, even by those who had seen the active progress of great works among us. It was supposed impossible to build a road 2,000 miles to connect St. Louis with San Francisco, across the mountains, although the map shows a line be-

ween St. Louis and New York, and between New Orleans and Brazos. What is there more difficult in one than in the other? It is said the country is unsettled! What was the country between Detroit and New Orleans, through which there are now 1500 miles of road, 25 years since? The settlement of the country goes on at a railroad pace. The frontier line of the country is 1,600 miles. Along this the population advance west, at the rate of 1,000,000 souls per annum. The demand for a railroad in 1850 came from 20,000,000 people, without any answering reply from beyond the Rocky Mountains. The demand is now prolonged by 30,000,000, to whom 500,000 voices from the Pacific coast respond. Before the roads can be constructed, if now undertaken, 40,000,000 on the east of the mountains will be eager to communicate with 1,000,000 on the western slopes. These vast numbers will be pressing toward each other, so as to shorten the purely through route, increase the local traffic at both termini, and a terminus which shall be 500 miles south of one centre and 500 miles north of another, will not suffice. The mind at once becomes impressed with the necessity of having *three*. Let us revert thirty years, to the connection of the Atlantic with the Mississippi river. Suppose the necessity of a railroad connection had then been agitated to run 12 or 15 hundred miles to St. Louis; that one connection would have ill supplied the numerous routes that now cross the country between Canada and Charleston. A parallel case will soon present itself with the western slopes, and three routes will be found by no means too many, either to answer the purposes of communication or to accommodate the travel. The requisites of a road are *shortness* and *cheapness*. These are relative. The road which is shortest and cheapest to connect the Columbia river with the great northern interests, including those of Canada, which concentrate round Lake Superior, is not the shortest and cheapest mode of reaching New Orleans from San Diego; nor would a route between the two latter at all accommodate those northern interests. The Pacific railroad extended from St. Louis to San Francisco would be the shortest and cheapest for those central interests, but it could not advantageously do the business of the other sections.

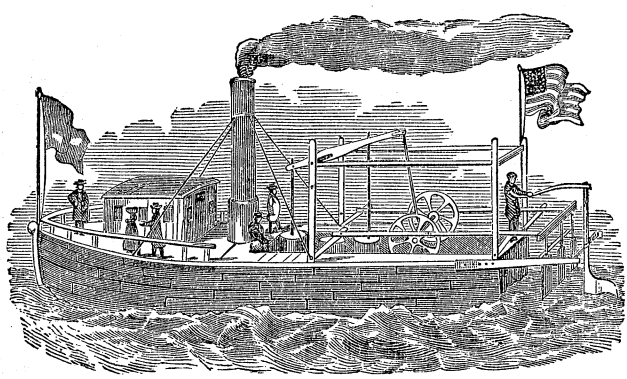
Each of these sections has large means that can be applied to the construction of a road that would serve their necessities, but which could not be enlisted in favor of one that would be of no direct benefit. If, therefore, the government should give authority for the construction of three roads, with a grant of six-mile sections along the route of each, and in addition aid each by a grant of $50,000,000 of 5 per cent. bonds, taking a first lien upon the road, the local interests of each section would complete the balance. Migration will follow these lines of communication, settling the best lands, until those coming east will meet those proceeding west, and a continuous line of settlement will follow the rising sun from New York to San Francisco, and the entire Union be united with the waters of the Pacific, that bring the commerce of Asia on the east, and with those of the Atlantic, that float its commerce with Europe on the west.

The Pacific railroad, though long discussed, was not definitely located, nor the company incorporated, till July 1st, 1862, and acts amendatory of it were passed July 2d, 1864, March 3d, 1865, and July 3d, 1866. By this act, the right of way, to the extent of 200 feet in width on each side of the railroad, was granted to the company; and also every alternate section of public land, to the amount of five alternate sections per mile, except mineral lands; and also provided for issuing thirty-year government bonds, to the amount of $16,000 per mile, for every section of forty miles completed, to the company, such bonds constituting a first mortgage on the road. Under this act and its amendments, the road was commenced from both termini, and has been vigorously prosecuted. On the 1st of January, 1867, there were completed about 305 miles of the eastern division, extending to within 200 miles of Denver, Colorado; and it was progressing at the rate of from one to two miles per day. Of the western division, 156 miles east from Sacramento, to the state line, was to be finished by July 1st, 1867, and to Salt Lake, 675 miles from Sacramento, by 1869. It is expected to be completed in its whole extent by 1870. The completion of this road will bring the carrying trade between Europe and Eastern Asia through the United States, and will greatly facilitate the development of the vast mining interests of the Rocky Mountain and Pacific regions.



THE SECOND EXPERIMENTAL BOAT OF JOHN FITCH.

Finished in May, 1787, and run at the rate of four miles per hour on the Delaware. Cylinder twelve inches in diameter, stroke three feet.



THE FIRST STEAMBOAT EVER BUILT TO CARRY PASSENGERS.

Constructed by John Fitch, and finished April 16th, 1798. Cylinder eighteen inches in diameter, speed eight miles per hour in smooth water. The following year this boat was run to Burlington regularly as a passenger boat.